JULY 26, 1954

Electrical World

Price 35 Cents

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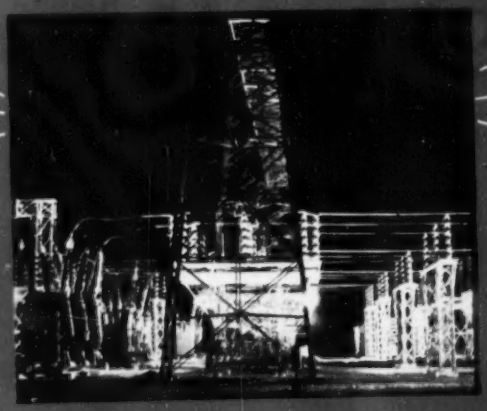
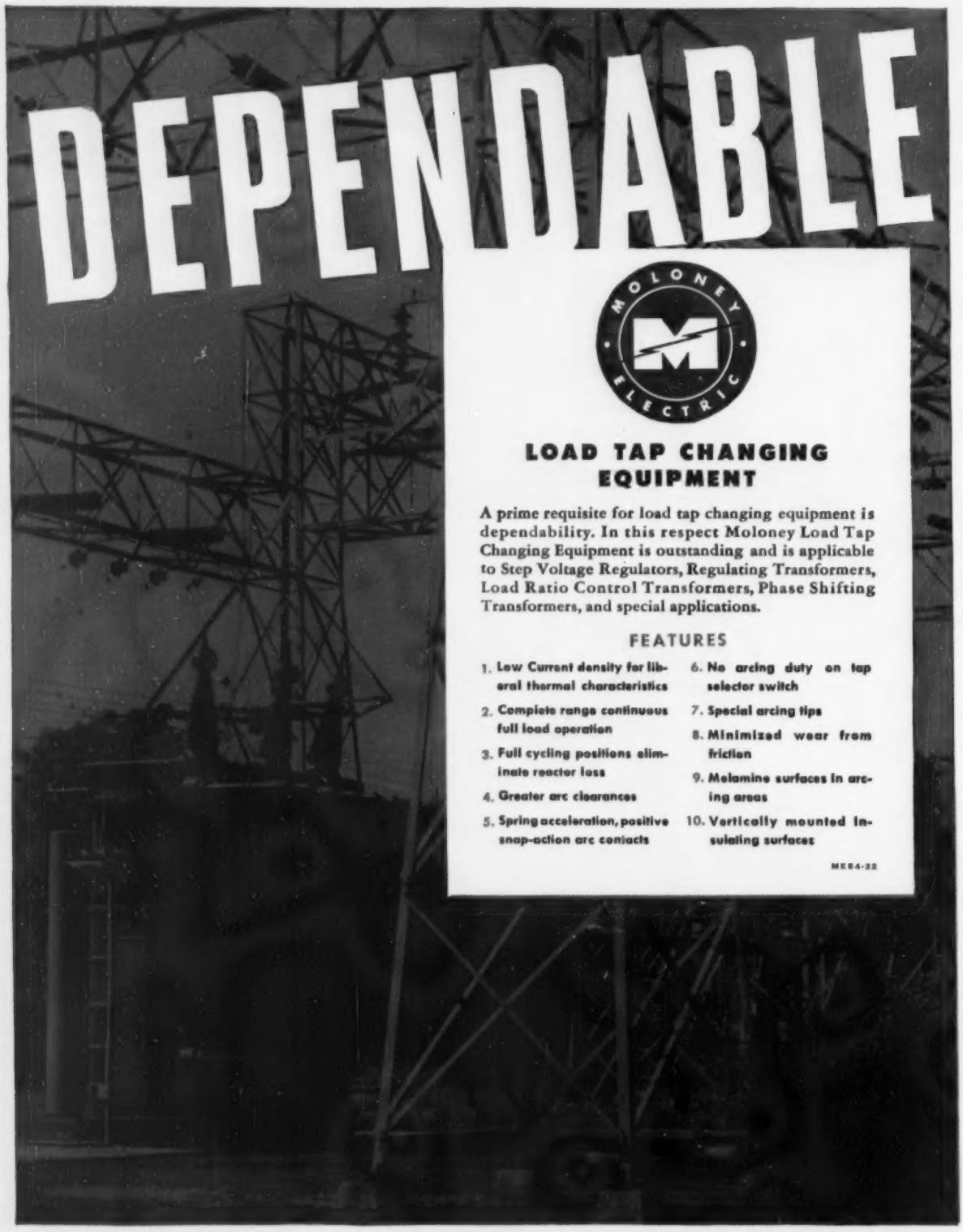
Pennsylvania Power & Light
and
Metropolitan Edison . . .



. . . complete substation at Hosensack for new 220-kv interconnection

For successful and beneficial applications of electric power by industry see Industrial Applications on page 146



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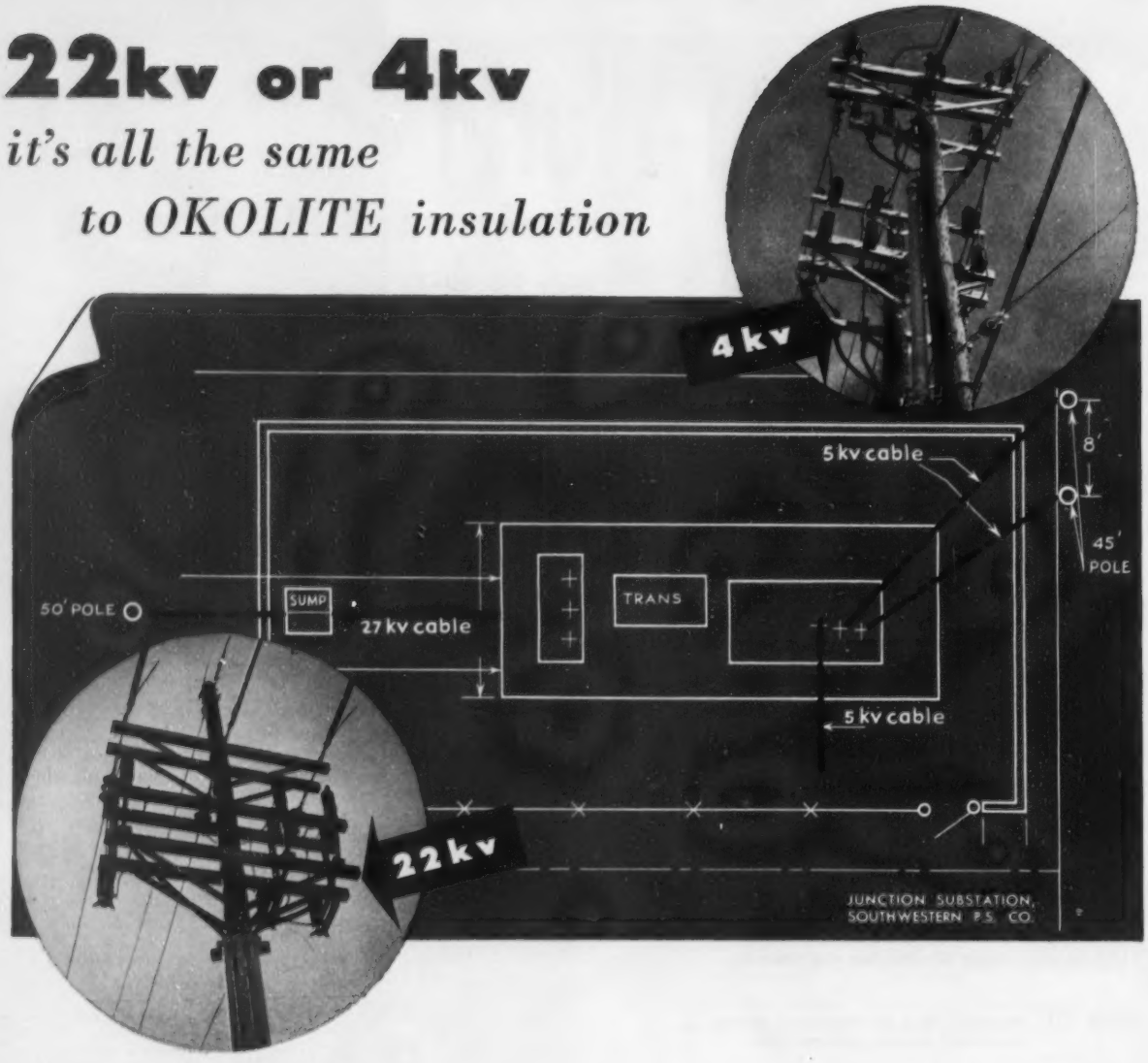

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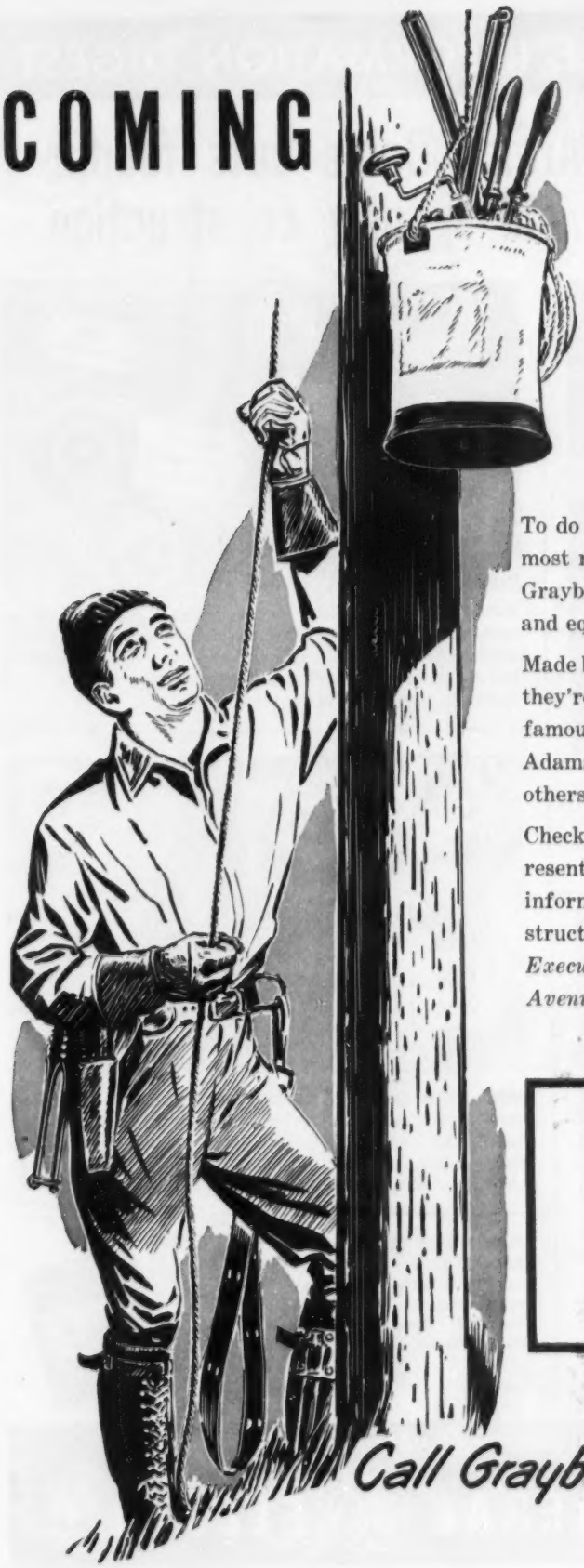

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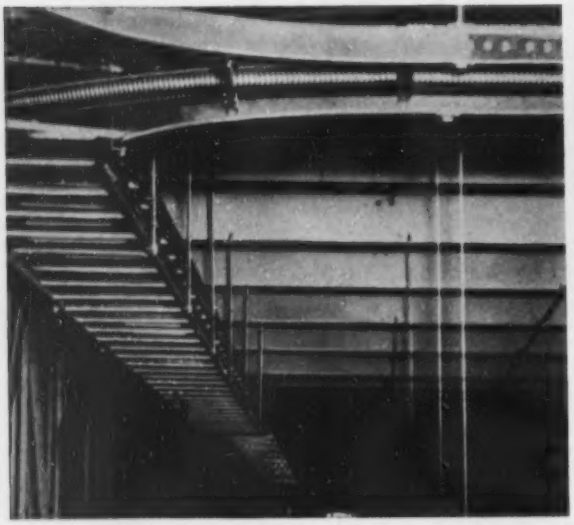
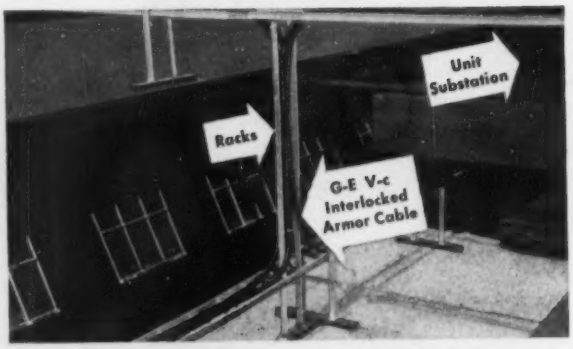
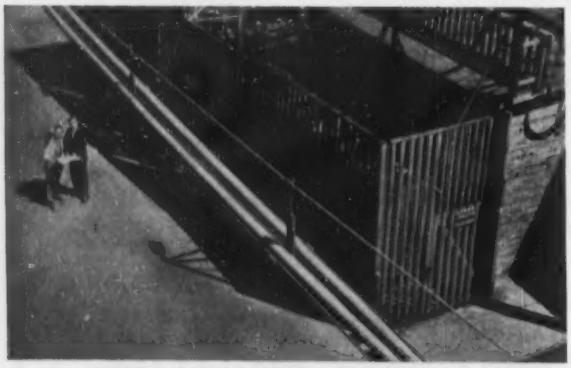


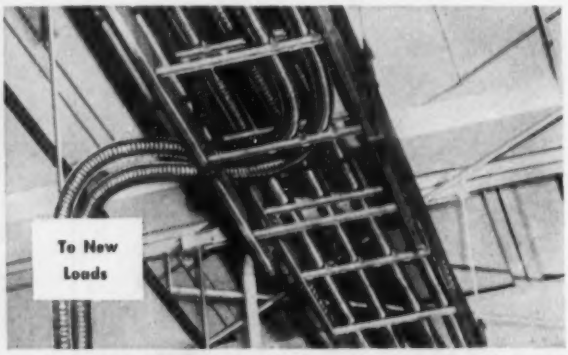
HANG IT FROM THE CEILING—You can install V-c interlocked armor cable in long unbroken runs over beams, around corners, even in unusually cramped areas. Splicing, where needed, is a simple mechanical job. These features often reduce layout and installation time by 50%.



RUN IT OVER THE ROOF—Uneven roof contours are no obstacle. Used this way, V-c interlocked armor cable frees working areas without expensive underground duct work or tearing up of concrete floors. It gives extreme economy and flexibility to power distribution.



HANG IT BETWEEN BUILDINGS—A G-E V-c interlocked armor cable system weighs only about one third as much as conventional cable and conduit. This means easy handling—indoors or outdoors. Fewer cables, plus simple messenger or rack support further reduce installation time.



MEET LOAD CHANGES QUICKLY—EASILY—G-E V-c interlocked armor cable primary or secondary feeder systems can be installed quickly. Each circuit is a separate, flexible cable that needs no conduit. You can easily expand or relocate any circuit to meet changes in load pattern.

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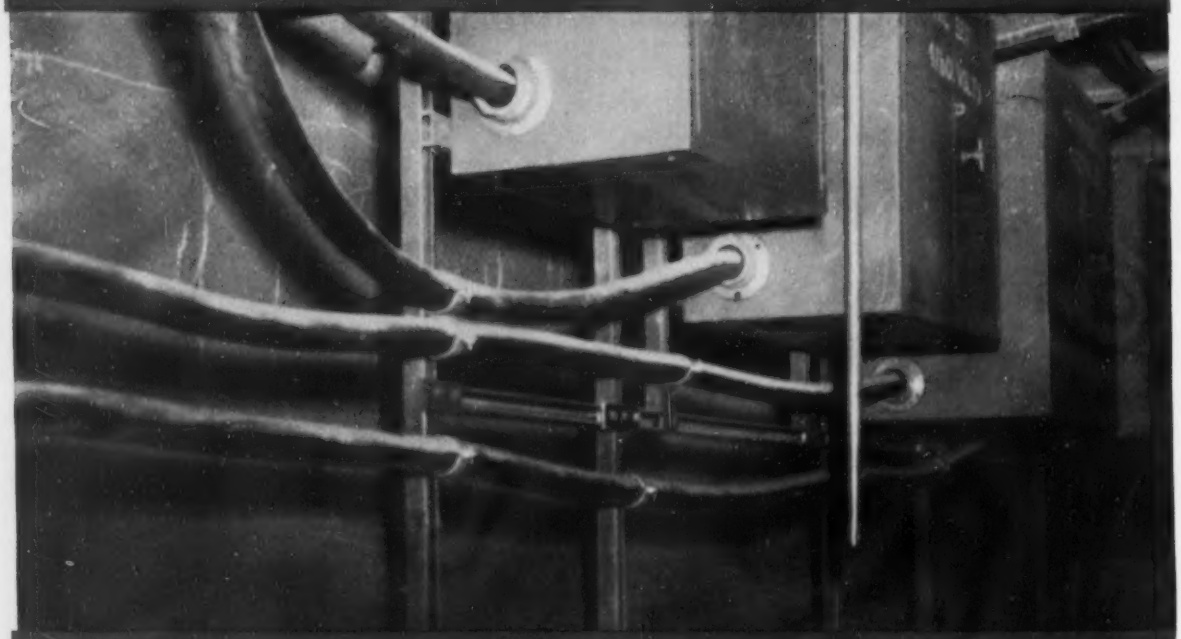

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A lot depends upon a trustworthy high voltage distribution system. Should this cable carrying 4160 volts from substation to circuit breakers fail, the cost in terms of lost production and work hours would far exceed the price of a new cable.

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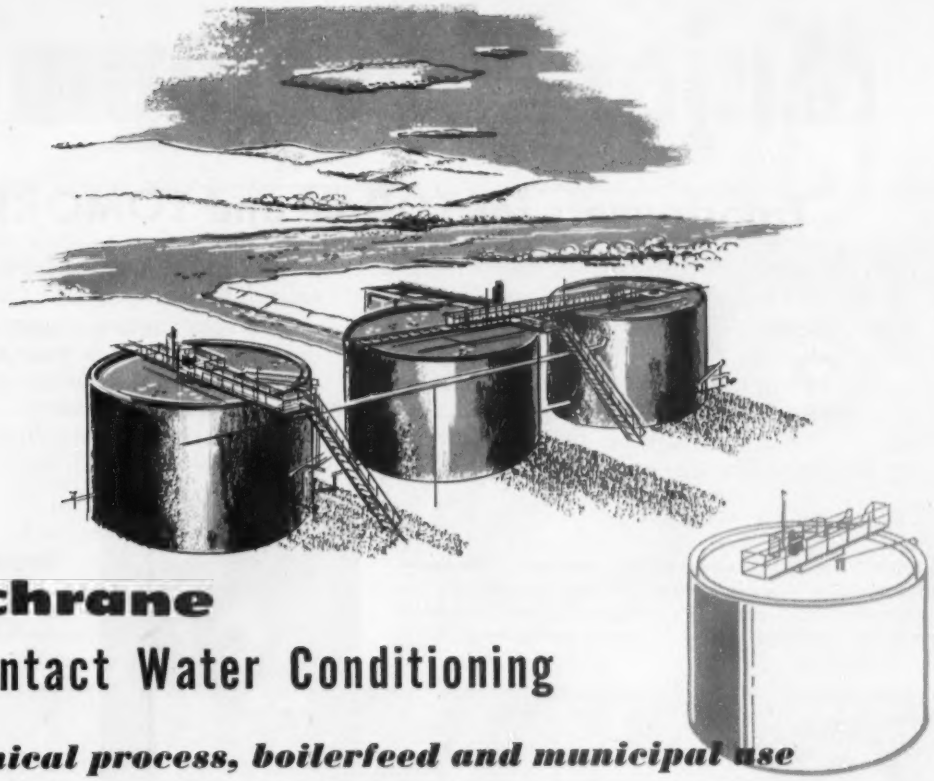

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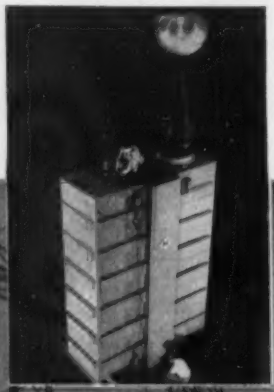
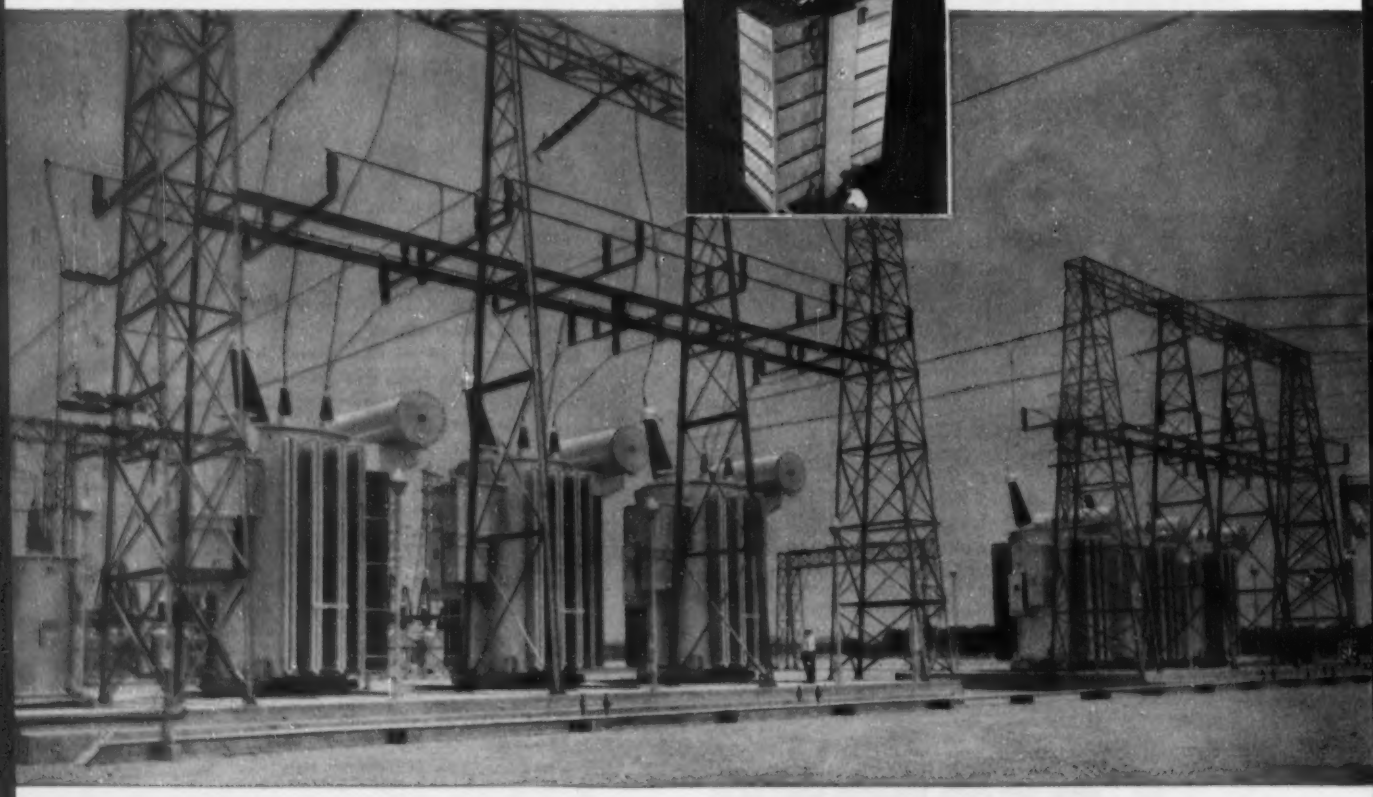
This combination of practical experience and development work is your assurance that you can depend on A-C for transformers engineered to meet your requirements . . . all, of course, incorporating *corona-free* design for long, trouble-free insulation life. A-4294

At right: Capable of operation on 600-kv transmission line now — possibly on 880-kv line in the future, this 5000-kva commercial-type power transformer proves that Allis-Chalmers transformer engineering is ready for transmission voltages far beyond present levels.



Below: Two 90,000-kva banks of load ratio control transformers on 230-kv lines of Southern California Edison Company.



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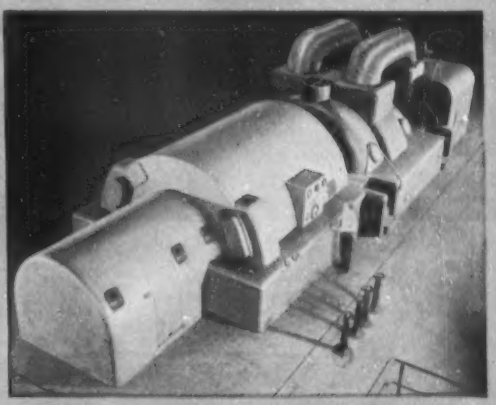
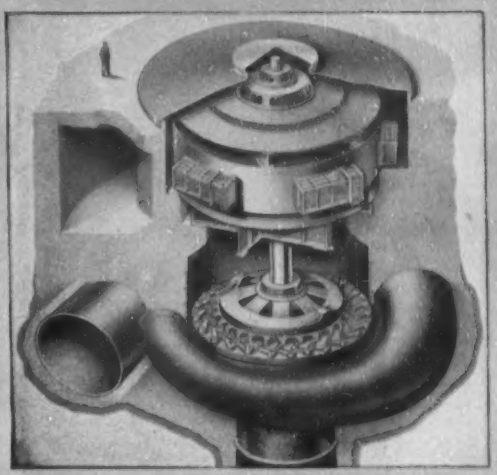


Reversible Pump-Turbine Units

Pioneered by Allis-Chalmers, reversible pump-turbines can solve some troublesome peak load problems. They do this by reducing the amount of equipment formerly needed for pumped storage operation; the single unit operates alternately as a turbine-generator and as a motor-driven pump. One 20,000-hp pump-turbine is now in operation, and four others are in production, with turbine ratings ranging from 12,650 to 120,000 hp. The latter will combine the world's largest motor, with a rating of 102,000 hp, and the largest Francis turbine ever built.



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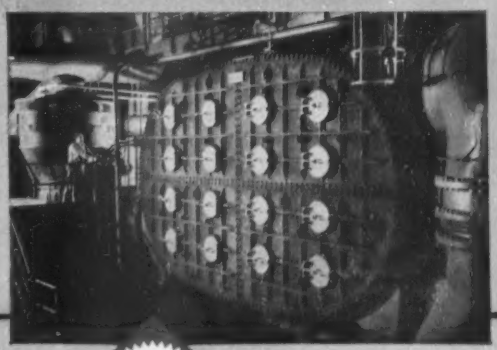
Allis-Chalmers is supplying six 100,000 sq ft surface condensers for the 2,200,000 kw of added private utility capacity being provided for AEC's Ohio diffusion plant. A-C multi-steam-path condensers have consistently helped to cut power costs. With 60 years of experience building over 13,000,000 sq ft of condenser capacity, A-C has the proven engineering and manufacturing facilities to build the largest condensers that might be required.



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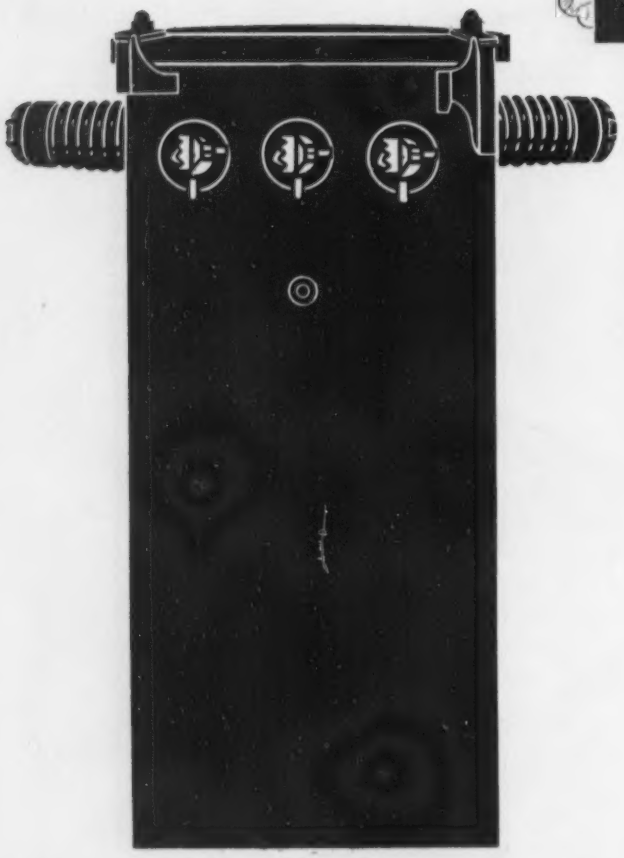
Kuhlman Distribution Transformers seldom require maintenance



Because of their design and construction, Kuhlman Distribution Transformers help utilities provide a steady and reliable source of power for American homes at a minimum of maintenance. Construction is sturdy and rigid. Tanks are fabricated of heavy gauge copper bearing steel, tested, and weatherproofed. For voltages through 4800 V., "Quick-Grip" clamp type insulated bushings simplify installation. Tap changer handle extends above oil level so adjustments can be made easily.

The major portion of Kuhlman pole type Distribution Transformers incorporate the well known Bent Iron Core. This core, permitting the flux path to follow the grain of the steel, utilizes the best qualities of cold-rolled oriented silicon steel. Considerable weight savings, reduction in core loss, and low exciting current result.

By achieving balanced design through the Bent Iron Core and other features, Kuhlman Distribution Transformers are engineered to provide exceptionally good voltage maintenance and high efficiency under varying load conditions. Wide oil ducts permit good oil circulation through the windings, maintaining relatively uniform coil temperatures. Kuhlman Transformers, of course, are vacuum treated to insure against trapped air.

Kuhlman Distribution Transformers are available in single and three phase ratings from 3 to 500 KVA. For complete information, write for Bulletins CS 201, CS 202 and CS 203. Kuhlman also manufactures Power, Dry Type, Saf-T-Kuhl, CSP, Subway and Series Street Lighting Transformers. Write for bulletins on these types as well.

152-T

KUHLMAN

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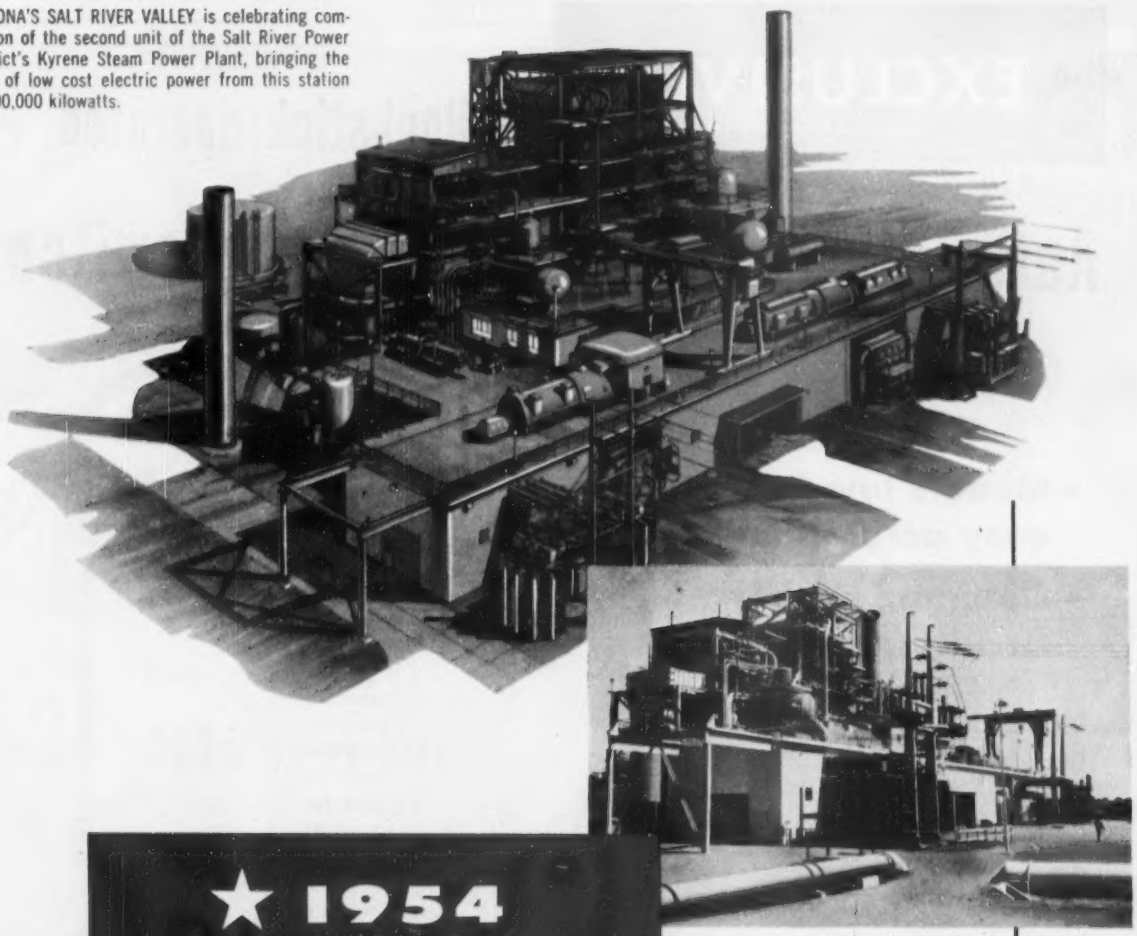

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The efficient new Kyrene plant illustrates the fine job of public service being done by the electric utilities. To keep ahead of the vast growth in demand they have increased their power production four-fold, investing 17 billion dollars in construction since the mid-thirties.

★ **And while the cost of living doubled, the average cost of electric energy was cut almost in half—through the continuous improvement of facilities and operations.**

In the technical aspects of this program Bechtel works closely with the power industry. Kyrene is an example—a case of designing and constructing the right plant for a utility's specific requirement.

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BUILDERS FOR INDUSTRY

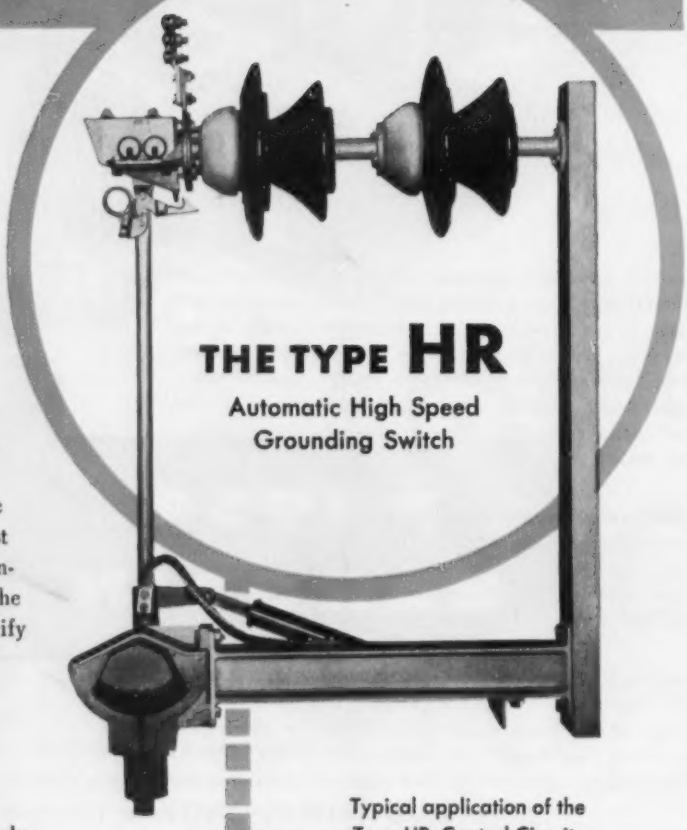
BECHTEL CORPORATION SAN FRANCISCO *Los Angeles* *New York*

EXCLUSIVE! Hookstick operated

Automatic high speed grounding switch

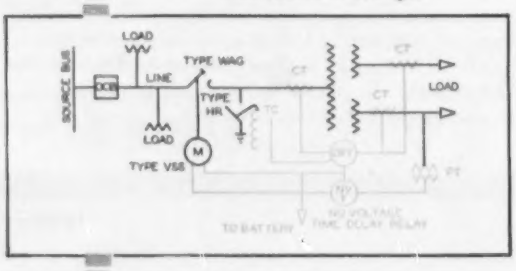
- **Mounts low for easy accessibility**
- **Eliminates costly circuit breakers**

Southern States alone makes an Automatic High Speed Short Circuiting Switch that is opened and reset by a hookstick. It is the Type HR, a complete unit with spring power integrally contained. The Type HR can be mounted on most structures at a *low, accessible level* and is easily isolated for periodic testing. This switch is ideal to furnish low-cost protection that would otherwise require expensive circuit breaker installations. Check all the features and see why it will pay you to specify Southern States Type HR switches.



- Hookstick operated
- Simple and easy to install
- Guaranteed operating time within 30 cycles
- Available in voltage ratings from 34.5 kv to 161 kv
- Momentary rating of 20,000 amperes and four second rating of 12,600 amperes
- Mounts on most structures
- Time tested and proved on nation-wide installations

Typical application of the Type HR. Control Circuits are shown in orange.

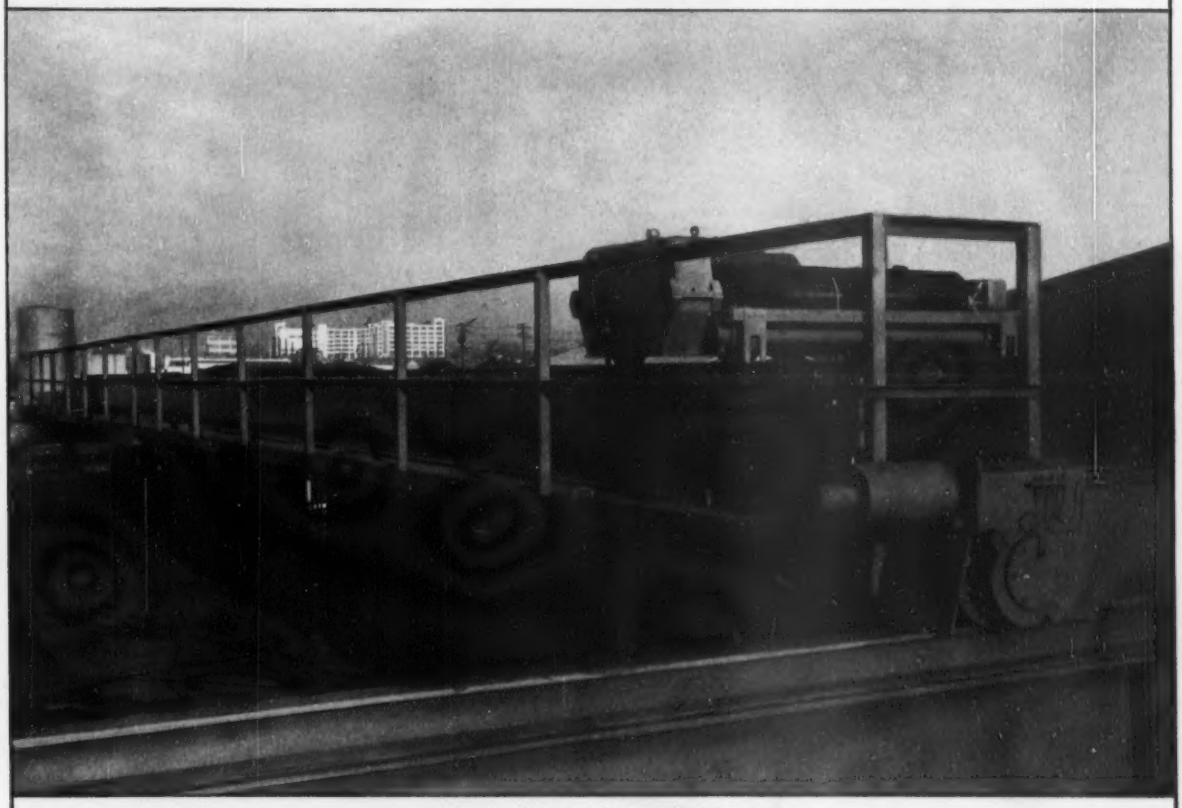


SOUTHERN STATES EQUIPMENT CORP.
HAMPTON, GEORGIA

5 TON BRIDGE CRANES

built by PACECO

"TAILORS OF STEEL"®



Portsmouth Project, Portsmouth, Ohio

Twenty of these 5 ton cranes were sold competitively in Ohio on a delivered price basis. All parts of the crane were built, assembled and tested at Paceco's plant prior to shipment.

Large crane features were incorporated on these 89' span bridge cranes. Hoist drive gearing, bridge drives and trolley drives run in rugged, all-welded, oil-tight cases; all open gears are eliminated.

All-welded trolley with built-in Paceco Load Brake Reducer is stress relieved and machined after fabrication, insuring accurate, permanent alignment of all trolley machinery.

Bridge girders are all-welded box type construction. Bridge trucks are line bored in pairs to insure accurate wheel and bearing alignment.

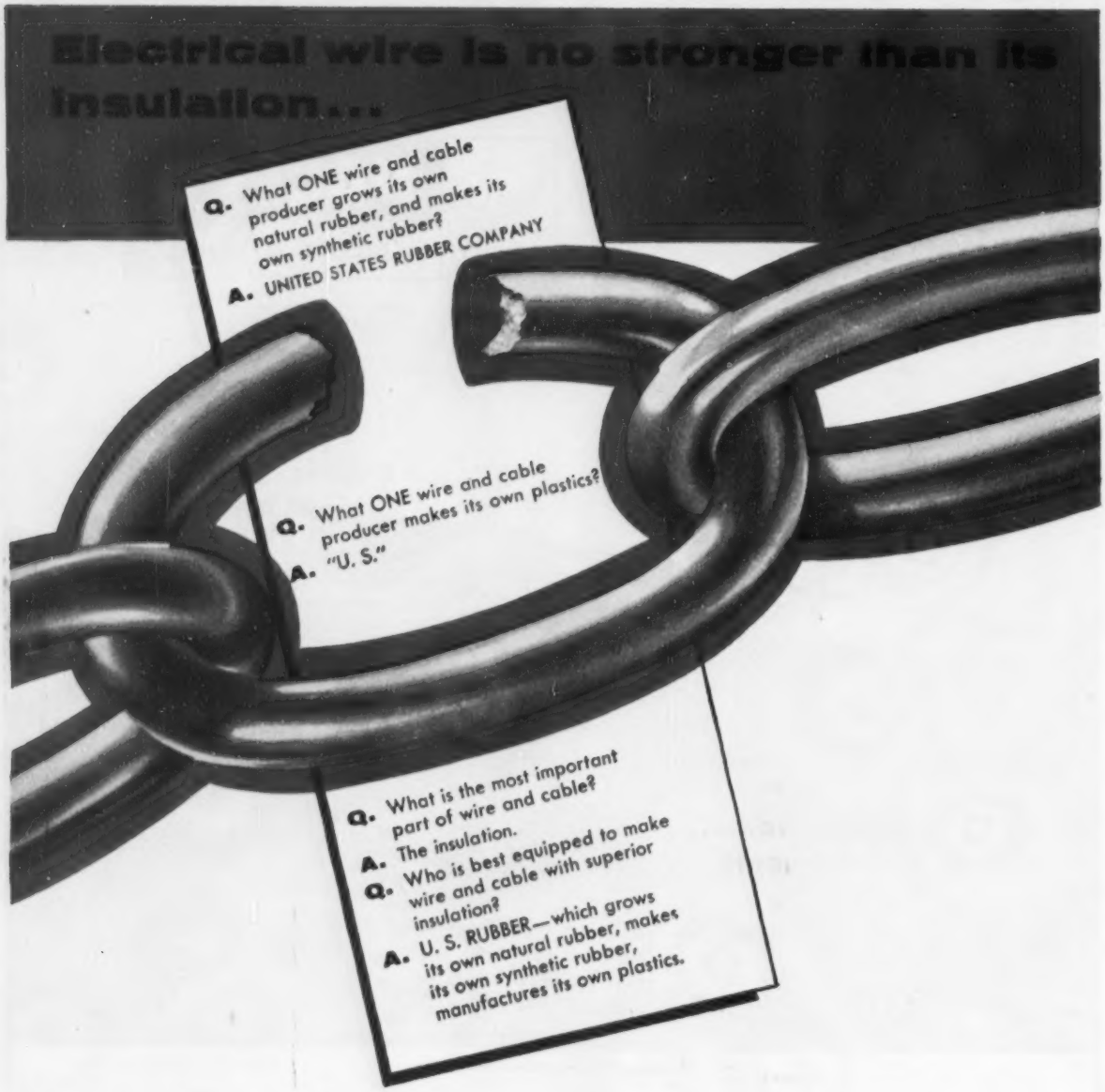
Paceco invites your inquiries when your needs fall within our scope of service, including cranes, gates, hoists, penstocks, pipe, valves and other units requiring skilled fabrication of metal plate and precision machine work.

One job . . . one responsibility.

PACIFIC COAST ENGINEERING COMPANY

Alameda, California

ENGINEERS • MACHINISTS • FABRICATORS


Electrical wire is no stronger than its insulation...
Q. What ONE wire and cable producer grows its own natural rubber, and makes its own synthetic rubber?
A. UNITED STATES RUBBER COMPANY
Q. What ONE wire and cable producer makes its own plastics?
A. "U. S."
Q. What is the most important part of wire and cable?
A. The insulation.
Q. Who is best equipped to make wire and cable with superior insulation?
A. U. S. RUBBER—which grows its own natural rubber, makes its own synthetic rubber, manufactures its own plastics.

ELECTRICAL INSULATION IS A "U. S." SPECIALTY!

Isn't it logical that a rubber company should make the best wire and cable insulation there is? U.S. Rubber has been a pioneer in insulation for close to 70 years—has amassed in that time a stockpile of research data and experience that can't be beat. Electrical insulation is a "U.S." specialty! Electrical insulation makes the difference between superior and ordinary wire and cable. Conductors of all manufacturers are standard, but insulation must be the best that science can produce. That's why your best bet in wire and cable is U.S. Rubber.

US RUBBER

UNITED STATES RUBBER COMPANY

ELECTRICAL WIRE & CABLE DEPARTMENT • ROCKEFELLER CENTER, NEW YORK 20, N. Y.

POWERS American SERVICE BODIES AND EQUIPMENT

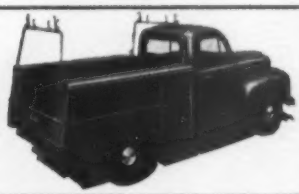
The 1 Source
for utility bodies and equipment!

If your work calls for one service body or a hundred . . . if you can use standardized units or require custom-made equipment . . . you'll find a body to fit your needs in the Powers-American line. Ladders, reels, racks, hooks, brackets, shelves, and other special items of equipment, can be furnished for your particular work requirements.

May we help you with your service body problems? Complete details will be sent upon request.

Series 44L and Series 44 (shown above) designed for any general service work. Fully-equipped with shelves and bins. For ½, ¾, 1, and 1½ ton chassis.

Series 25T and 35T arranged for telephone installation and service. Widely used in other phases of utility work. Available in ½ and ¾ ton sizes.



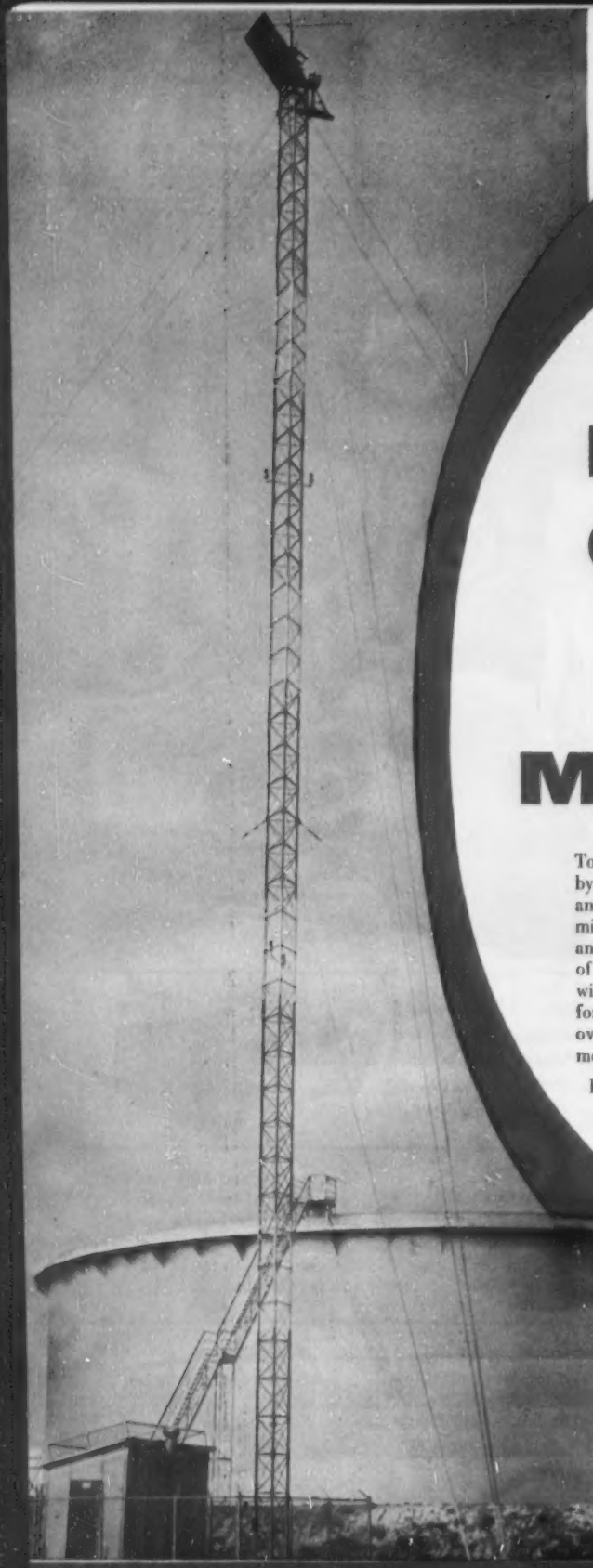
Series 25M and 35M used for all types of general service. Especially suitable for electric meter installation and maintenance. Models for ½ ton and ¾ ton vehicles.

Series 25G and 35G designed for use in the installation and servicing of gas meters. Equipped with meter hold-downs, bins, and pipe rack. In ½ and ¾ ton sizes.

POWERS-AMERICAN DIVISION

McCABE-POWERS AUTO BODY COMPANY

5900 NO. BROADWAY • ST. LOUIS 15, MO.
428 LATHAM SQ. BLDG. • OAKLAND 12, CALIF.



Complete PIPE LINE CONTROL with PHILCO MICROWAVE

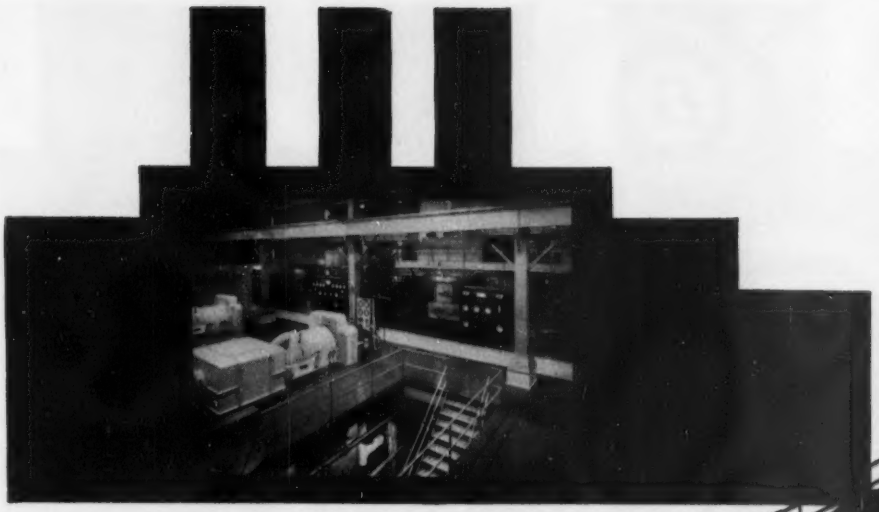
Today, 1000-mile-plus pipe line operations are being controlled by microwave. Automatically recorded pressures, rates of flow, and tank level readings are instantly and accurately transmitted to headquarters and division stations. To these automatic and unattended control features of microwave, add the privacy of microwave telephone and teletype communication. Integrate with these features the selective remote control of VHF radio for dispatcher-to-car communication, through any fixed station over the entire microwave system . . . and you have a truly modern communication system.

Philco Microwave provides complete tie-in with existing pipe line facilities. Let Philco Microwave help you control your operations more efficiently—at lower costs! For complete information, write to Dept. EW today.

PHILCO *Famous for* QUALITY *the World Over*

PHILCO CORPORATION

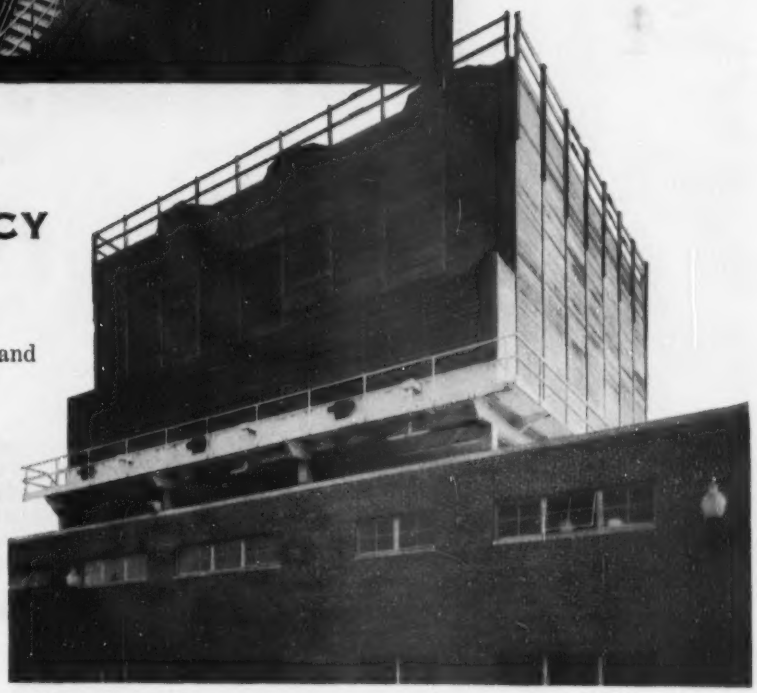
GOVERNMENT & INDUSTRIAL DIVISION • PHILADELPHIA 44, PA.



MODERNIZE FOR EFFICIENCY

. . . INSIDE AND OUT!

When you modernize your power plant to increase output and efficiency, it's always evident that the cooling requirements of your new generating equipment should be served with equally modern facilities to achieve the most economical operation possible. That's why you see Pritchard cooling towers and air cooled heat exchangers performing vital cooling jobs in so many modern power installations.



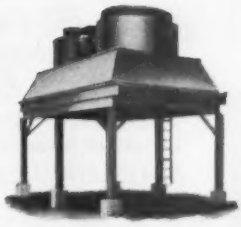
There are three good reasons why Pritchard cooling equipment does those jobs better: practical design, exclusive equipment features, quality construction. This all adds up to long, trouble-free, dependable cooling service. To get that for your installation, be sure you get Pritchard.

Industry's Partner for Progress

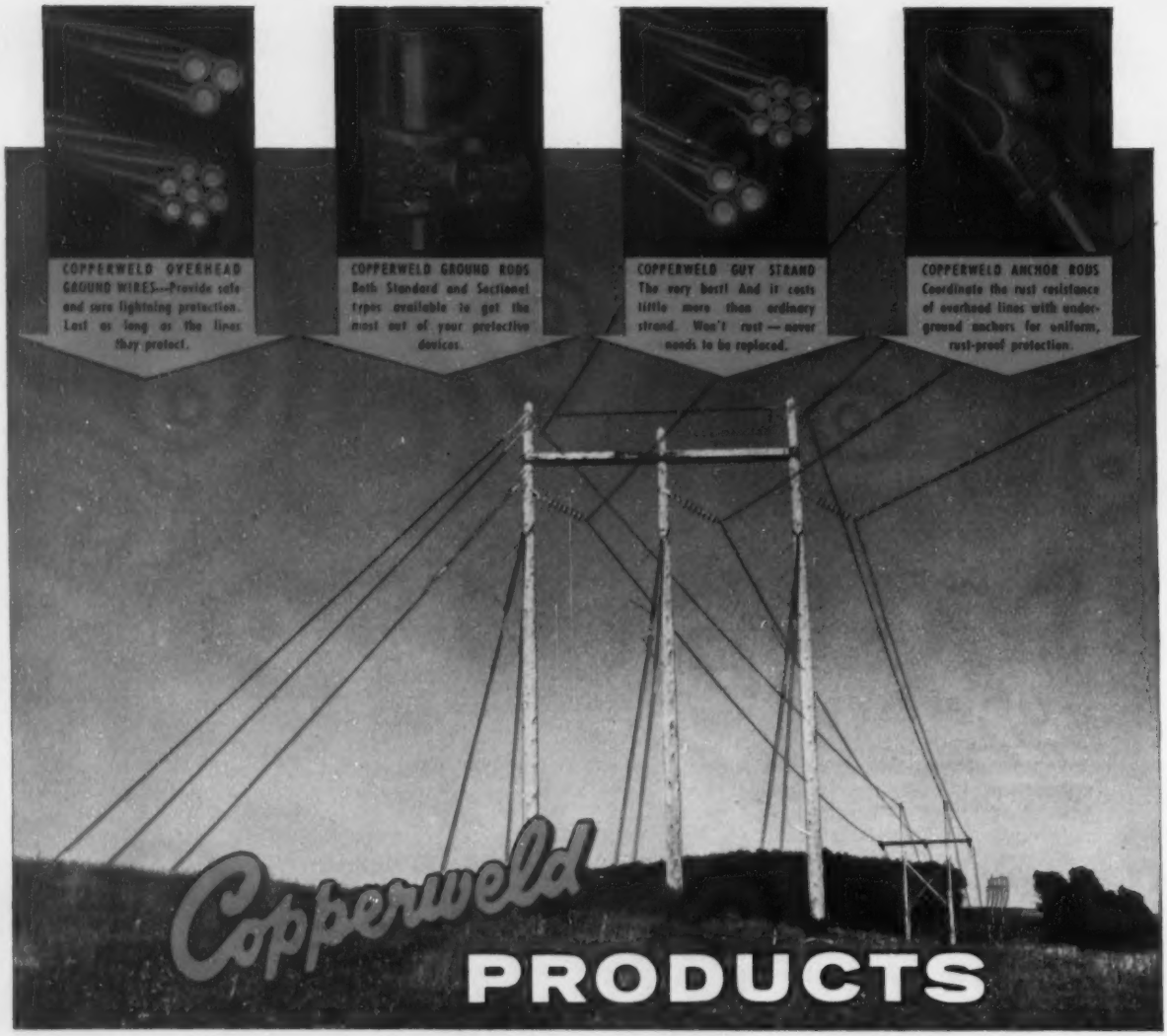
J. F. Pritchard Co.
OF CALIFORNIA
A DIVISION OF J. F. PRITCHARD & CO.
Dept. 383, 210 West 10th St., Kansas City 5, Mo.

COOLING TOWERS
AIR COOLED HEAT EXCHANGERS
GAS & AIR TREATING EQUIPMENT

Representatives in Principal Cities from Coast to Coast



You'll obtain maximum heat transfer . . . with maximum savings . . . in jacket water cooling or other cooling operations with Pritchard QUINTAIR® air-cooled heat exchangers. In addition to the induced draft QUINTAIRS shown, forced draft units are available to meet specific operating requirements.


COPPERWELD OVERHEAD GROUND WIRES—Provide safe and sure lightning protection. Last as long as the lines they protect.
COPPERWELD GROUND RODS Both Standard and Sectional types available to get the most out of your protective devices.
COPPERWELD GUY STRAND The very best! And it costs little more than ordinary strand. Won't rust — never needs to be replaced.
COPPERWELD ANCHOR RODS Coordinate the rust resistance of overhead lines with underground anchors for uniform, rust-proof protection.
Copperweld
PRODUCTS

For GROUNDING and GUYING

UNEQUALED in performance! UNRIVALED in long life! UNSURPASSED in economy!

Good engineering goes hand in hand with the best materials, especially for grounding and guying. That's why so many power systems, railroads and communication companies buy Copperweld* Products. There is no better way to keep overhead down and to be assured of constant, uninterrupted service. Use Copperweld Products on all your installations—it pays!

Trade Mark

COPPERWELD STEEL COMPANY
WIRE AND CABLE DIVISION Glassport, Pa.

SALES OFFICES IN PRINCIPAL CITIES
For Export: Copperweld Steel International Company, New York

Good Engineering Demands The Best Materials... Copperweld PRODUCTS

Combine the strength of steel with the conductivity and permanence of copper.

it's time for a new meter...

when Mrs. Riley...

gets her electric range

Since the day she took up the role of homemaker, Edith Riley has had a gas stove, of one kind or another, in her kitchen. But times have changed, and, well . . . the Rileys are getting an electric range this time.

The Rileys, and the thousands of American families like them who are turning to electricity to do more and more things, are going to need high capacity meters.

There is a new extended range meter on the market that will easily handle the heavier loads created by the rapidly increasing use of electricity. It's the Sangamo J2, a 15 ampere meter with straight-line accuracy up to 100 amperes. As a matter of fact, the J2 has the capacity to carry 100 amperes *continuously* without overheating, yet it has sufficient torque to accurately measure even the lightest load.

When you invest money in meters you know are going to have to handle greater and greater loads, protect your investment by choosing a meter with plenty of reserve ability to measure the growing use of electricity.

Choose the new Sangamo J2—the first . . . and finest . . . 15 ampere meter with 100 ampere capacity.

A METER WITH STRAIGHT LINE ACCURACY

UP TO 100 AMPERES

SANGAMO
ELECTRIC COMPANY
SPRINGFIELD, ILLINOIS

JM54-7

DROP-FORGED for GREATER STRENGTH

BTC

M.P.L. Aluminum

SUSPENSION CLAMP

for A.C.S.R.

and All-Aluminum Conductors

MINIMUM POWER LOSS

INCREASED CONDUCTOR LIFE

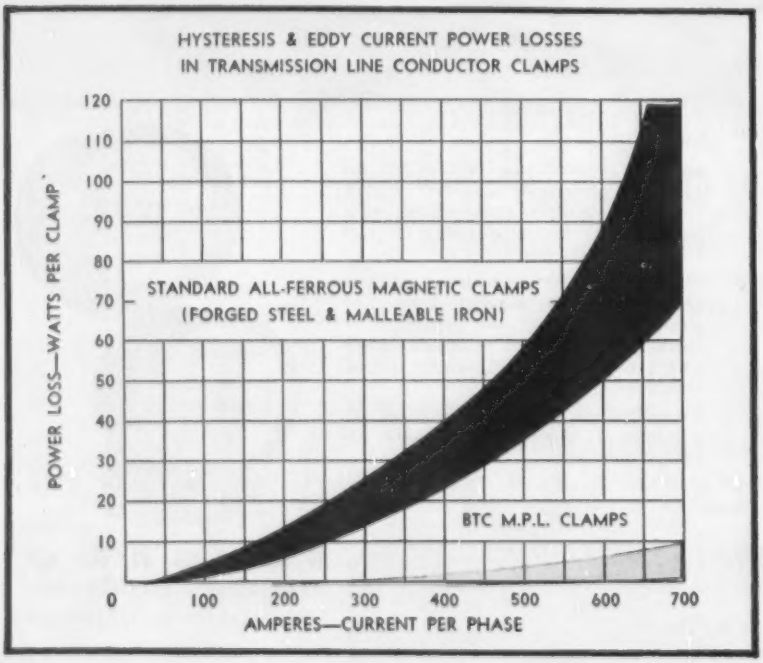
STRONGER

MPL **MINIMUM POWER LOSS**

The use of non-magnetic Aluminum Alloy Clamp Body reduces eddy current and hysteresis losses to a minimum . . . prevents temperature rise in the clamped section of the conductor, which will operate at lower temperature than in the span.

CONSIDERABLY STRONGER

Forgings, in any metal, are employed where better strength, soundness and finish are required than can be obtained by other processes. Forging produces a fine, close-grained structure, with the grain flow following the contour of the part and with optimum mechanical properties and ability to withstand severe loading, sudden shock and frequent reversal of stress.

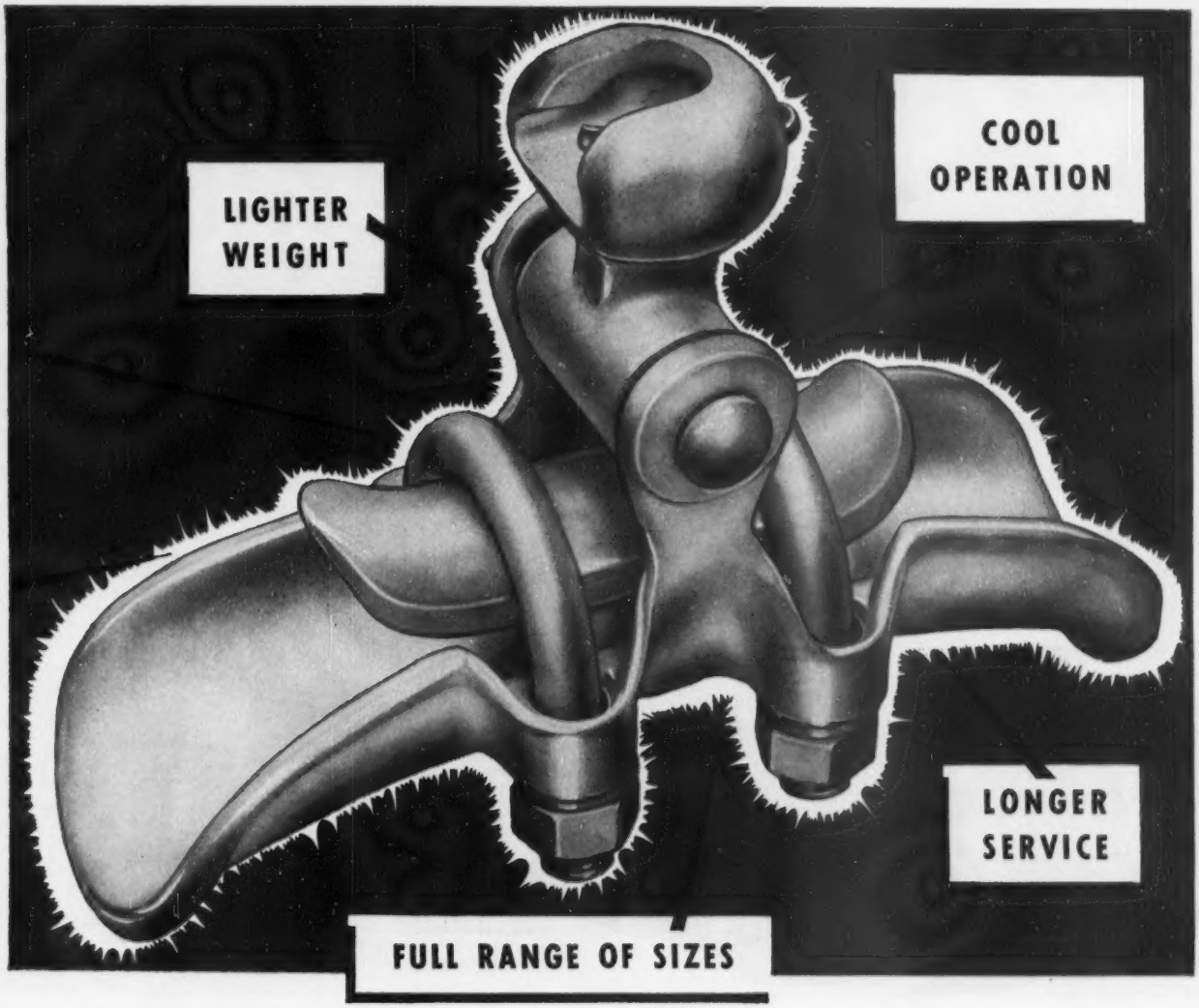


The BTC Clamp Body is FORGED Aluminum alloy, the strongest recommended for the purpose, fully heat-treated to develop maximum mechanical properties.

In the heat-treated condition, the ultimate strength and hardness is more than twice . . . and the yield strength and endurance limit more than three times . . . that of alloys used in other processes. The more-than-adequate catalouged strength ratings of BTC Clamps are conservative and are exceeded in actual tests.

LIGHTER WEIGHT

Heavy sections or reinforcing ribs, necessary in other materials to develop desired strength and prevent collapse or breakage of the clamp under clamping U-Bolt pressure, are not required in forged clamps. Undesirable weight is eliminated without sacrifice of strength.



INCREASED CONDUCTOR LIFE

The light weight and generous longitudinal radius of the conductor seat minimize the effects of conductor vibration. The conductor is not bent over a small radius at any point.

Clamping pressure is greatest at the center, gradually decreasing toward each upswept end of the keeper. Clamp and Keeper ends are liberally bell mouthed and beaded to prevent conductor damage and formation of corona.

The conductor is fully supported in the clamp body. There are no open pockets at U-Bolt holes to allow distortion of the conductor under clamping pressure.

LONGER SERVICE

The superior strength insures against failure under severe loading. The greater hardness prevents excessive wear at points in contact with the supporting pin.

The close-grained, non-porous structure of the forged clamp body effectively prevents the destructive internal seepage of corrosive elements, a cause of failure in some transmission line fittings produced by other processes.

FULL RANGE OF SIZES

BTC offers a choice of exactly the right clamp for each size of A.C. S.R. or all-aluminum conductor. The close dimensional fidelity of the die-forged and die-formed parts makes unnecessary any bore size allowance for manufacturing variations in the clamps.

Specify BTC MPL Aluminum Suspension Clamps from your insulator manufacturer. They are an important part of BTC's complete line of forged transmission line hardware.

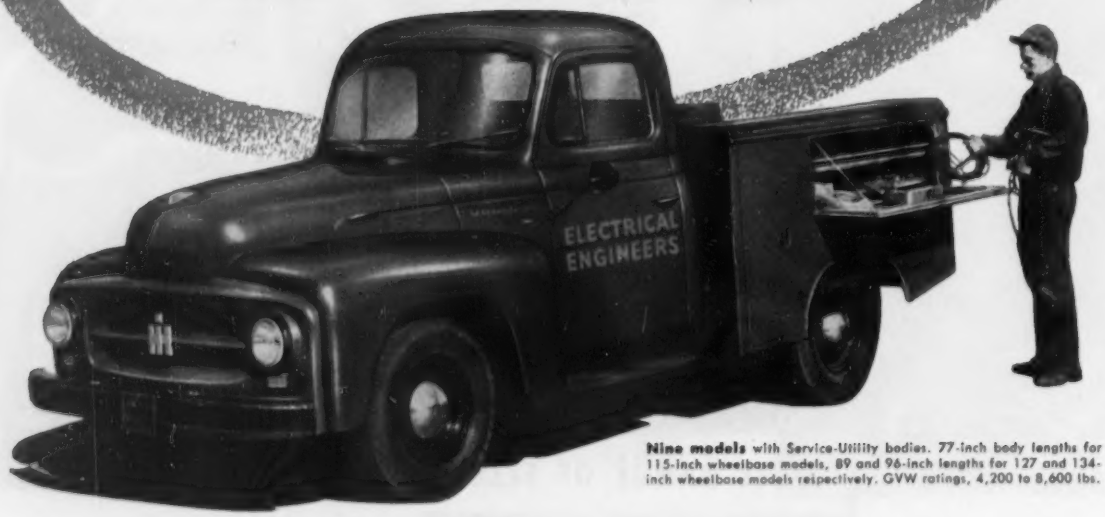
Sold Through Your Insulator Manufacturer Only

Drop Forged BTC *Hi-Line Hardware*

The BREWER-TITCHENER Corporation

Cortland • New York

Trip saver...
Time saver...
Money saver



Nine models with Service-Utility bodies. 77-inch body lengths for 115-inch wheelbase models, 89 and 96-inch lengths for 127 and 134-inch wheelbase models respectively. GVW ratings, 4,200 to 8,600 lbs.

An INTERNATIONAL Truck with Service-Utility body is one of the best ways ever figured out for reducing job installation and service call costs.

Take a look at the truck, first of all. It is built with the stamina that has made INTERNATIONALS famous for extra long life, extra-low maintenance. It has an INTERNATIONAL-built Silver Diamond engine—an *all-truck* engine of modern, low friction valve-in-head design, with every feature for utmost operating economy. It gives you a roomy, driver-designed Comfo-Vision cab—easy riding and handling—time-saving maneuverability—round-the-clock dependability.

Now look at the Service-Utility body. It is designed to save you trips and time. It has locking, all-steel compartments of various sizes that let you take all needed parts, tools, and equipment to the job on the first call. No more job-to-shop trips for forgotten items! No more wasted labor time! And it's available with pipe supports, vise bracket, and ladder rack to give you complete equipment for all kinds of work.

Let your INTERNATIONAL Dealer or Branch show you why this extra-efficient workshop truck is your all-around best bet for saving trips, time, and money. Time payments arranged, of course.

INTERNATIONAL HARVESTER COMPANY • CHICAGO

International Harvester Builds **McCormick®** Farm Equipment and **FARMALL®** Tractors...Motor Trucks...Industrial Power...Refrigerators and Freezers

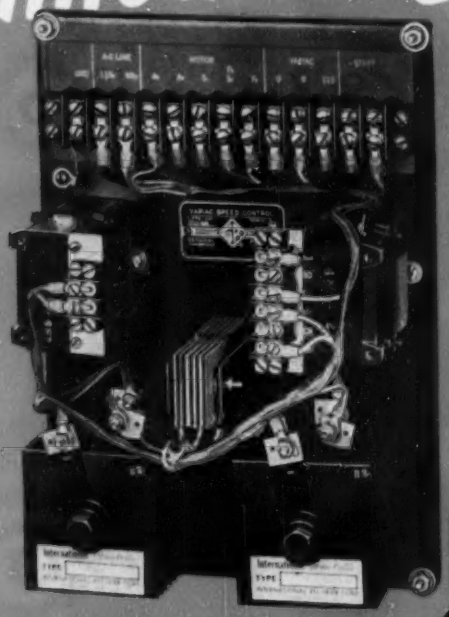
Better roads mean a better America

INTERNATIONAL® TRUCKS

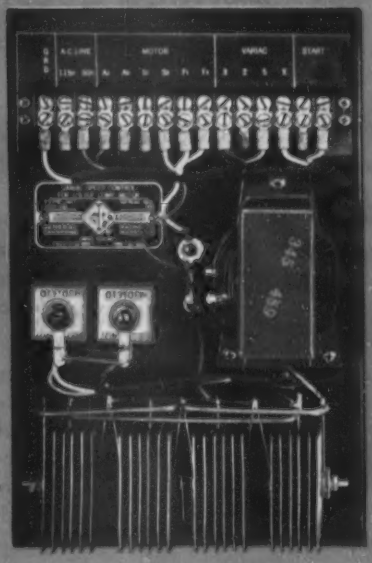
"Standard of the Highway"

Announcing

Stripped-down Models of the Variac MOTOR SPEED CONTROL



Type 1700-BS1 VARIAC® Motor Speed Control for 1/4 and 1/3 hp dc motors operating from ac lines. Compact, lightweight, simple to install.
Price: $135.00



Type 1703-AS1 VARIAC® Motor Speed Control for 1/6 hp and smaller motors.
Panel dimensions only 6-3/4" x 10 ".
Price: $93.00

To meet the requests of many manufacturers and users of the popular VARIAC® Motor Speed Control who want to build these versatile units into their own machines or equipment, we announce three models of these controls without cabinet, overload protection or switching.

Their maximum ratings are for 1/6th, 1/3rd and 3/4 hp motors. They consist of the basic components of the motor control, mounted on a panel and wired to a terminal strip to which are brought out all of the necessary leads.

All of the standard functions of the mounted models including fusing, dynamic braking and start-stop-reverse can be incorporated easily in the external circuits in the users equipment.

The sub-assembly is supplied separately for convenient mounting in any enclosure. The VARIAC® is furnished without protective cover.

Write for the VARIAC® Motor Speed Control Bulletin

These VARIAC® stripped-down units have all of the operating features of the mounted models including:

NO ELECTRONIC TUBES — *no warm-up required — long hours of life with minimum and simple maintenance*

HIGH STARTING TORQUE — *constant torque throughout the speed range*

WIDE SPEED RANGE — *continuously adjustable from rated speed to zero*

NEGLIGIBLE TORQUE PULSATION — *drive smooth enough for the most exacting work, even at lowest speeds*

SIMPLE INSTALLATION — *any electrician can install these units*

Type 1703-AS1 Variac Motor Speed Control ¼ hp
(panel dimensions 6¾" x 10") **Unit Price: $93.00**

Type 1700-BS1 Variac Motor Speed Control ⅓ hp
(panel dimensions 12¾" x 9¾") **Unit Price: $135.00**

Type 1702-AS1 Variac Motor Speed Control ¾ hp
(panel dimensions 13½" x 15") **Unit Price: $195.00**

We sell direct. Prices shown are NET, f.o.b. Cambridge or W. Concord, Mass.

Quantity Prices On Request

GENERAL RADIO Company

275 Massachusetts Avenue, Cambridge 39, Mass., U.S.A.

8055 13th St., Silver Spring, Md. WASHINGTON, D.C. 90 West St. NEW YORK 6
920 S. Michigan Ave. CHICAGO 5 1000 N. Seward St. LOS ANGELES 38

Your "burning question" is quickly answered—with

B&O Bituminous

Whether your specific question concerns power, coking, steam, or space heating, you'll find the perfect answer among the wide variety of Bituminous coals in Baltimore & Ohio territory. Here lies an almost inexhaustible source of low-cost heat and energy.

The benefits of B&O Bituminous are many. Highly mechanized mines keep production costs low, size and quality uniform. Closeness to America's industrial heart means economical transportation. The ease of storing coal eliminates the need for expensive facilities. And new methods and devices take further advantage of the burning characteristics of Bituminous.

ASK OUR MAN! He will help you find the exact coal for your purpose, and explain the best way to burn it. You'll be amazed at the efficiency, economy, and cleanliness of B&O Bituminous today.

BALTIMORE & OHIO RAILROAD

Bituminous Coals for Every Purpose

BIDDLE *Instrument News*

NEW PRODUCTS

New Biddle Dielectric Test Set Model 1-40 KV

—for measuring d-c current at voltages up to 40 kv when applied to the insulation of such equipment as generators, transformers, bushings and cable.

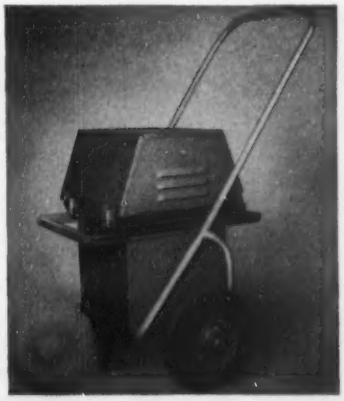
This portable field instrument has been developed in response to the growing use of and demand for higher d-c test voltages.

Carefully considered safety features, excellent output voltage regulation, simple operation, compact design, and facilities for making voltage and current measurements at either polarity have been incorporated in this test set. Years of Biddle engineering experience in insulation testing are reflected in this equipment which has already proven its reliability and performance in field use.

The set has a current rating of 25 milliamperes at short circuit, and current measurements can be made down to 0.5 microamperes which is the first division on the microammeter.

Overall dimensions are: height 19½ in., width 13½ in., depth 20 in., weight 120 lbs. All high voltage components are oil immersed.

For complete details, description, specifications, and prices, write for **Bulletin 22-W.**

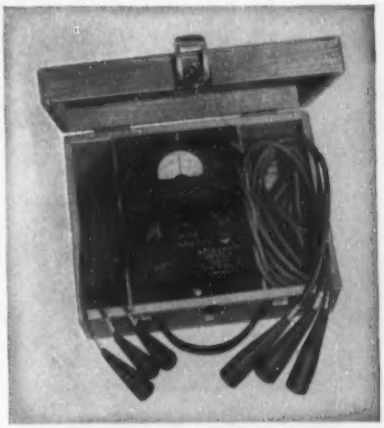


Showing The Biddle Dielectric Test Set, Model 1, on a special hand truck supplied as an accessory for this equipment. This truck permits one man to handle the set safely and without difficulty, on stairways as readily as on the straightaway.

Biddle Motor Rotation and Phase Tester (*Dual Purpose*)

With it you can . . .

- **Determine the direction of rotation of electric motors before they are connected to the line.**
- **Determine the phase rotation or sequence of energized power circuits.**



Here is a positive means for determining which motor leads must be connected to certain conductors of a supply system to insure that the motor will rotate in a prescribed direction when energized.

This device will permit the electrical contractor or industrial maintenance electrician to permanently connect and tape the terminals of the motor being installed, without having to first energize the motor by a temporary "hook-up" from a power source, if available, to determine its rotation.

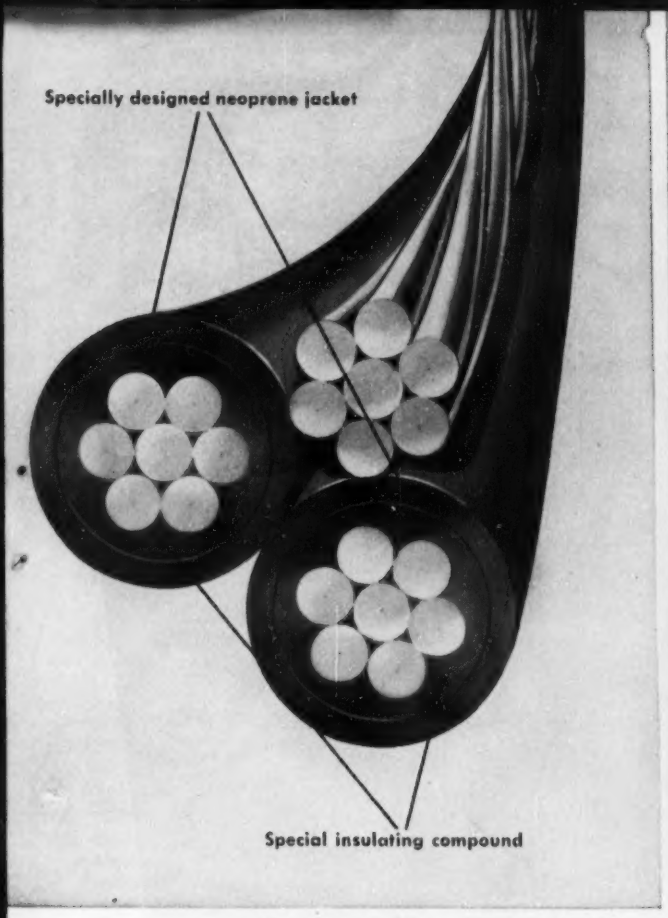
Housed in a sturdy oak case 12¼" x 8¼" x 4¼" this compact unit weighs approximately 10 pounds and is supplied complete with 3 line and 3 motor leads which store in the compartments either side of the instrument panel.

For complete details write for **Bulletin 80-W.**

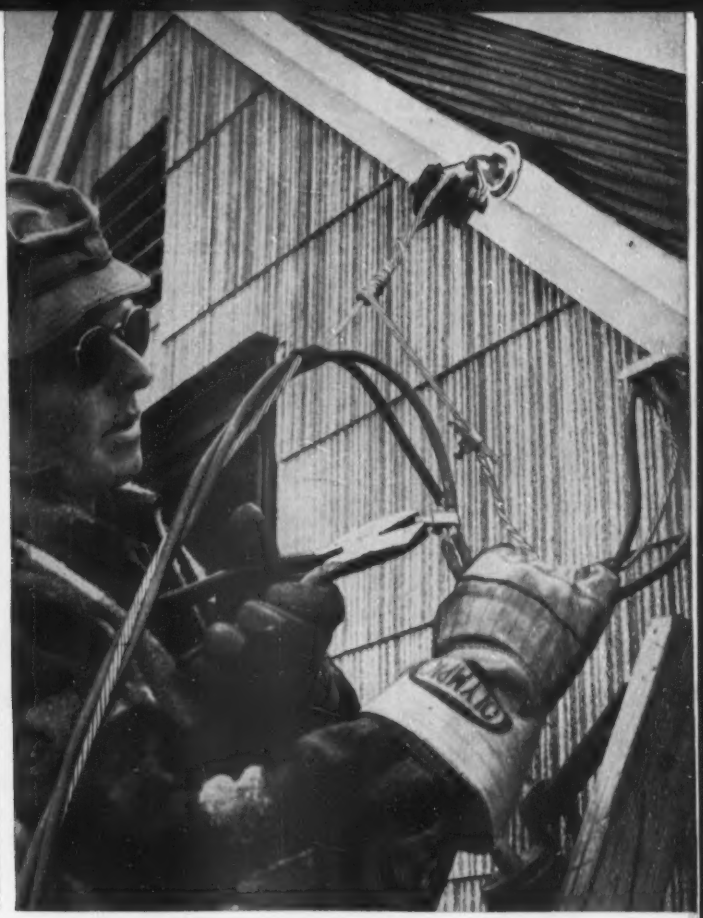
B-419

JAMES G. BIDDLE CO.
1316 ARCH STREET • PHILADELPHIA 7, PA.
ELECTRICAL TESTING INSTRUMENTS • SPEED MEASURING INSTRUMENTS • LABORATORY & SCIENTIFIC EQUIPMENT

SERVICE DROP



DOUBLE PROTECTION is important feature of Anaconda 2 + 2 Type N-SD service drop. Note inner and outer layers.



CABLE ENDS of Anaconda 2 + 2 Type N-SD are quickly and easily made ready for service connection.

Unique construction gives Anaconda 2+2 Type N-SD Cable double protection

NOW Anaconda offers a new Type N-SD service-drop cable – called 2 + 2. *Each* of its two conductors is covered with not one—but *two* durable, protective layers.

One layer is a fine insulating compound. The other is a tough jacketing material.

The compound for the inner layer has built-in electrical qualities—designed for heat and moisture resistance.

The outer layer is in fact a specially designed neoprene jacket—best for wear and weather resistance.

Together these two layers give *double* protection. That means longer life . . . greater service reliability.

See this cable for yourself. The Anaconda Representative nearest you will be glad to show you samples...and to answer your questions. Call him today. Or for more information, write *Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y.* 54445

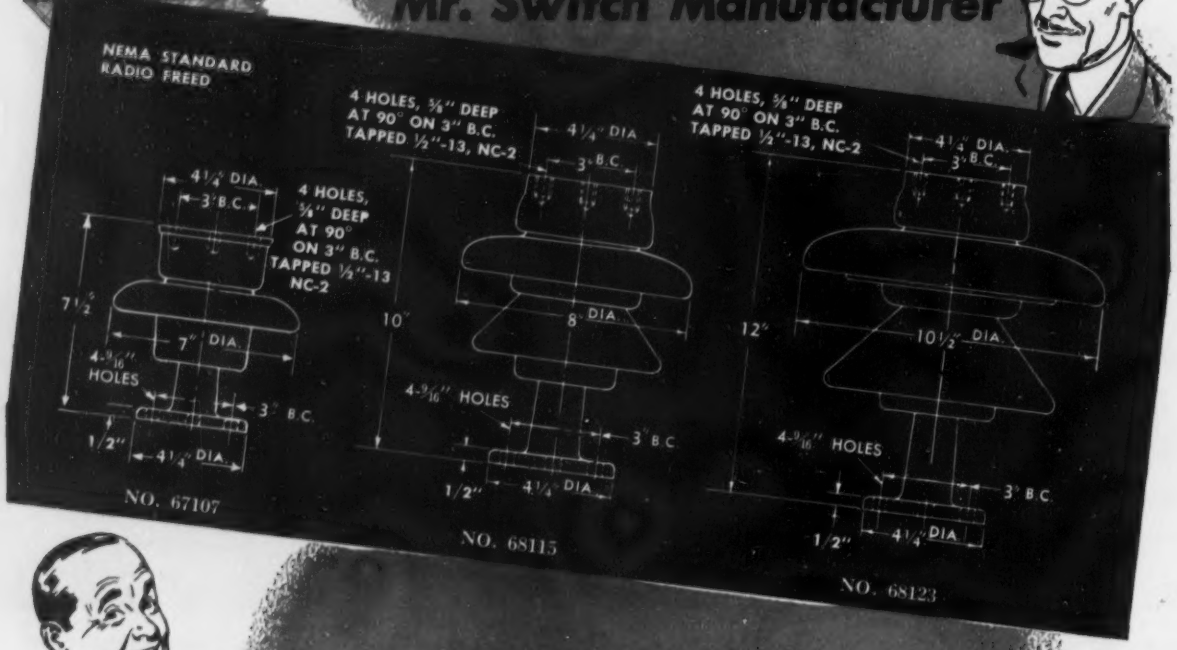
ANACONDA®

Power cables of all description • service and overhead distribution cable, bare and weatherproof, including ACSR • signal, control and communication wire • portable cords and cables • network cable • magnet wire • copper, aluminum and copperweld conductors • wire and cable accessories.

◀ **LINEMAN ON POLE** handles ANACONDA 2 + 2 Type N-SD Cable easily. Minimum effort speeds the lineman's work.

Mr. Station Designer

Mr. Switch Manufacturer



We'd Go Out of Business

if we depended on your replacing these rugged insulators!

Because—we build your Switch and Bus Insulators to last forever. We don't expect replacement business but look for your new business.

Finest Wet-process Porcelain—quality controlled, standard designs, expertly assembled, assure long life.

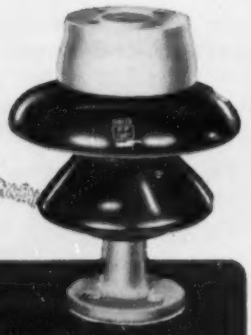
Dimensionally Standard Hardware Components—assure interchangeability—double hot-dip galvanized means low maintenance cost for you—precision jig assembled saves mounting time.

Rugged Designs—to give ample factors of safety over standard characteristics.

Exhaustive Routine Tests—Each shell and every insulator is tested in excess of AIEE-NEMA standards—your safety assured.

Availability—most sizes currently in stock.

PP INC.



YOUR INDEPENDENT INSULATOR MANUFACTURER

Porcelain Products, Inc.

PARKERSBURG, WEST VIRGINIA

Transmission Towers by AMERICAN BRIDGE handle nation's first 330,000-volt line

● The first leg of the American Gas and Electric Service Corporation's projected high voltage transmission network has been completed with the construction of a 63-mi. 330,000-volt, double circuit link running from Appalachian Electric Power Company's Kanawha River, W. Va., station to its Philip Sporn plant.

The towers for this record-setting line were designed and fabricated by American Bridge as the result of valuable data gathered from the A. G. & E. sponsored 500,000-volt test line at Ohio Power Company's Tidd plant, Brilliant, Ohio, in cooperation with other manufacturers of high voltage transmission line equipment.

These towers are approximately 150 feet tall and carry 6 conductors of 1,275,000 C.M., A.C.S.R. expanded cable (1.6"OD). The towers are designed for straight-line spans of 1700 ft.

The technical knowledge and field experience American Bridge has acquired in this and hundreds of other transmission line installations may be just the answer to your tower problems. Our engineers welcome an opportunity to figure with you without obligation. Just write to the nearest office listed below.

AMERICAN BRIDGE DIVISION, UNITED STATES STEEL CORP.
GENERAL OFFICES: 525 WILLIAM PENN PLACE, PITTSBURGH, PA.
Contracting Offices in: AMBRIDGE · ATLANTA · BALTIMORE · BIRMINGHAM · BOSTON
CHICAGO · CINCINNATI · CLEVELAND · DALLAS · DENVER · DETROIT · ELMIRA
GARY · MEMPHIS · MINNEAPOLIS · NEW YORK · PHILADELPHIA · PITTSBURGH
PORTLAND, ORE. · ROANOKE · ST. LOUIS · SAN FRANCISCO · TRENTON
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

DESIGN REDUCES FOUNDATION INSTALLATION COSTS. Important savings in time, labor, and materials were made possible through use of steel grillage earth anchors and variable leg extensions as shown above. Many other simplified installation and frill-free construction features are obtained through American Bridge designs.

USS TRADE MARK

AMERICAN BRIDGE

UNITED STATES STEEL

THE
Nicopress
SLEEVE
WITH THE
Nicopress
TOOL
...GIVES YOU A
PERFECT NICOPRESS
SPLICE
For use on Copper, Copperweld, and
All-Aluminum Conductors
Nicopress Sleeves and Tools Patented in U. S. and Foreign Countries. "Nicopress" Registered in U. S. and Foreign Countries.
The National Telephone Supply Company
5100 SUPERIOR AVENUE • CLEVELAND 3, OHIO
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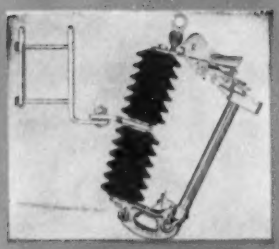
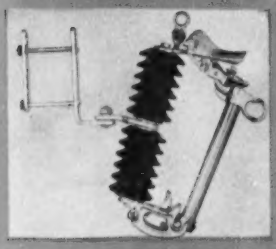
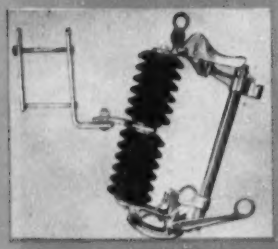
THE NATIONAL TELEPHONE SUPPLY COMPANY



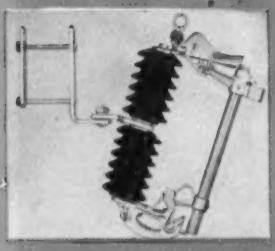
Type 33-D



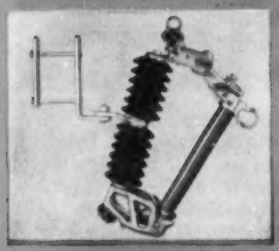
Type 33-DH



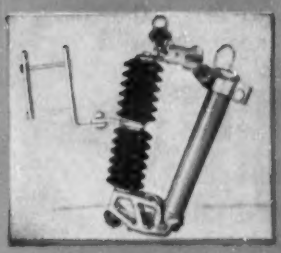
Type L-33-D



Type CV-33-D



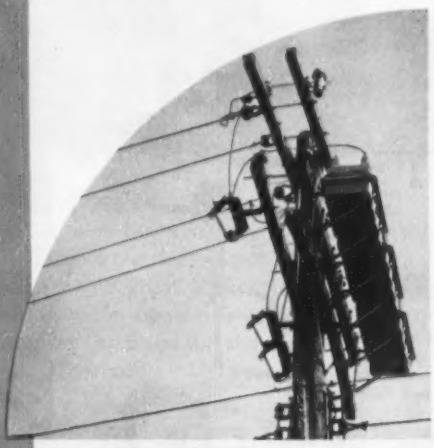
Type H-33-D

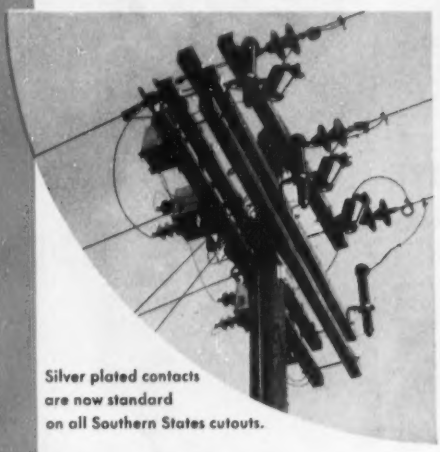


Type HH-33-D

58 Combinations

to meet your cutout requirements





Silver plated contacts are now standard on all Southern States cutouts.

No matter what your fusing problems are—excessive load-growth, isolated or special applications, meeting a tight budget, or others—Southern States cutouts will help you lick them. In the 33 series, fifty-eight combinations of voltage, current and interrupting ratings are available.

From this versatile line—ranging from the Type 33-D, to the extra heavy-duty, Type HH-33-D—you can select the cutout that meets your exact requirements.

Three methods of tube venting, interrupting ratings from 1,200 to 25,000 RMS amperes and continuous current ratings from 50 to 300 amperes, enable you to choose the cutout you need.

Complete data and information are available in our Bulletin 530-C, which we'll gladly send you on request.

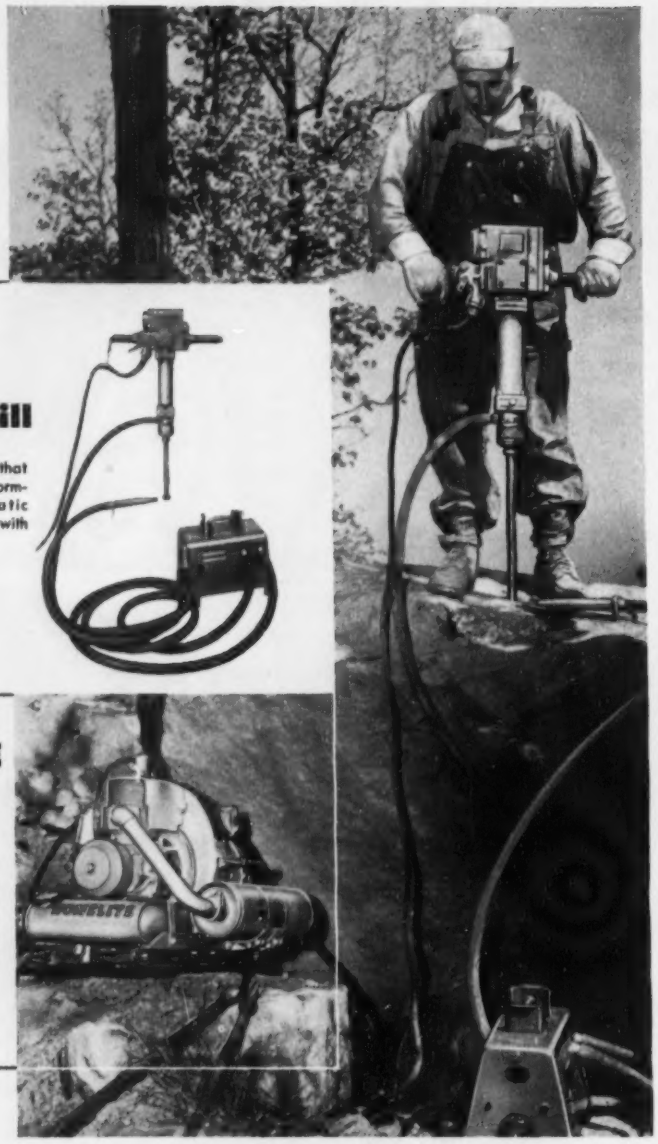
Specify Southern States cutouts and be certain.

SOUTHERN STATES EQUIPMENT CORP.

HAMPTON, GEORGIA

Announcing BOSCH

High Cycle Electric Tools



Paving Breaker

FOR:
Demolition
Breaking Out
Chiseling
Clay Spading
Tamping
Asphalt Cutting
WEIGHT—64 lb.

Rock Drill

A lightweight tool that matches the performance of pneumatic Drills. Equipped with Pressure Blower.

WEIGHT:
Drill—65 lb.
Blower—20 lb.

Hammer

A Lightweight Builders Hammer

FOR:
Chiseling
Chipping
Drilling
Cutting
Same Tool
Drills & Strikes

WEIGHT—14 lb.

HOMELITE Dual Purpose Generator

The power supply for Bosch tools — 2,500 watts — operates both High Cycle tools and Standard 110 volt electric tools and floodlights.

WEIGHT 138 lbs.

These ruggedly built tools are real cost cutters on any job. They combine low initial cost with low operating cost for unexcelled economy.

Lightweight — simple in design, yet they give performance equal to bulky, expensive, compressed air equipment.

HIGH CYCLE electric motors, powered by Homelite's dual purpose generator, will give you greater flexibility and thousands of hours of heavy-duty service. Ask for an on-the-job demonstration or for more information. Write Homelite Corporation, Port Chester, New York.

Manufacturers of Homelite Carryable Pumps • Generators Blowers • Chain Saws

PERFORMANCE · DEPENDABILITY · SERVICE

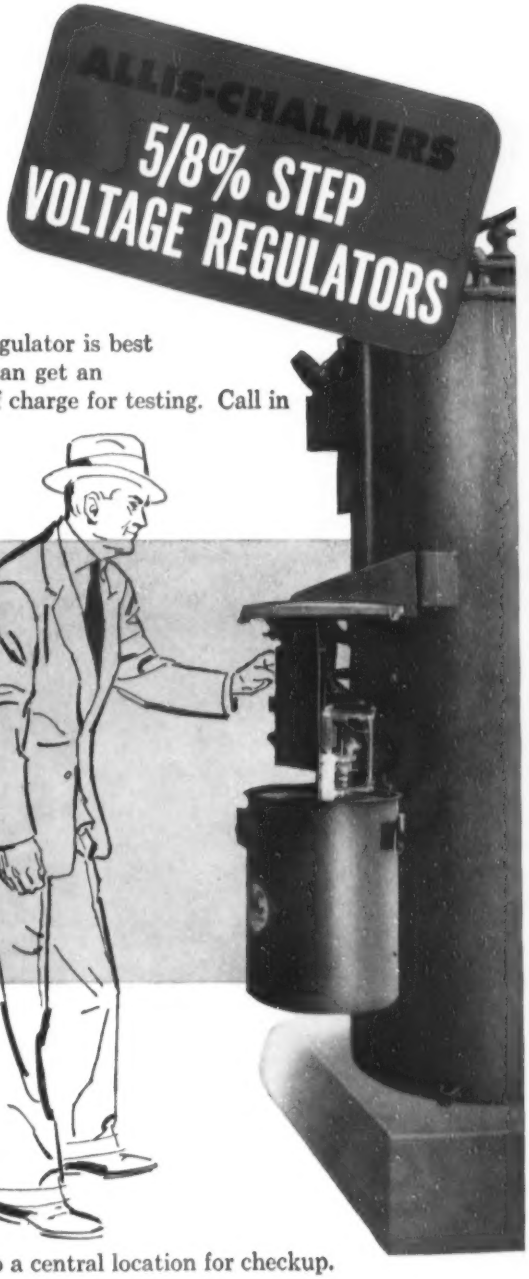
HOMELITE CORPORATION

6107 RIVERDALE AVENUE • PORT CHESTER, N. Y.

Canadian Distributors: Terry Machinery Co., Ltd., Toronto, Montreal, Vancouver, Quebec.

Does your regulator meet the test?

Compare FOR YOURSELF



Thirty days of free examination: that's how Allis-Chalmers helps you decide which regulator is best for your system. Any recognized distribution system can get an Allis-Chalmers distribution regulator completely free of charge for testing. Call in your engineers, purchasing people, operating and maintenance men and let them see for themselves which regulator is best. Compare all the features.

Compare the Control, Too

For example, *Feather-Touch* controls on Allis-Chalmers regulators give you ± 1 volt band, Class I accuracy. No wonder users report revenues increasing, profits up on lines with A-C distribution regulators. Friction can never upset this control because the floating beam of the regulating relay completely eliminates mechanical bearings.

Simple Service

Feather-Touch controls also offer a good example of the simple service requirements on A-C distribution regulators. To remove and replace the control all you do is pull a single jack plug. Your linemen don't have to be technical experts because controls can be returned to a central location for checkup.

Get complete information. Better yet, get a regulator you can test for yourself. Call your nearby A-C office or write Allis-Chalmers, Milwaukee 1, Wisconsin, for a test regulator and for the recently published "regulator check list" that will help you analyze all regulators.

A-4356

ALLIS-CHALMERS

ORIGINATORS OF 5/8% STEP REGULATION

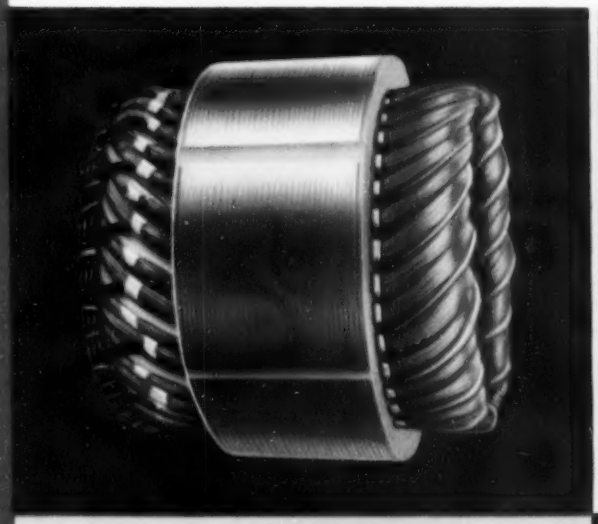
Get Greater
with New Features

Motor Economy
. . . Proved Principles

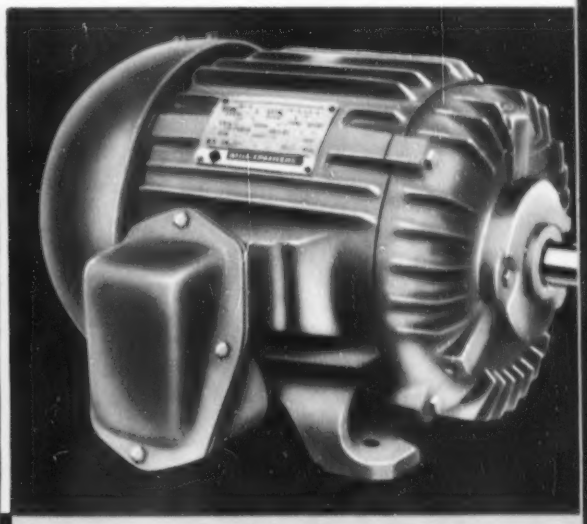
Here's the inside story of a great new motor. It combines the best of the new developments in methods and materials with the best of the tried and proved principles that have made such an outstanding record for Allis-Chalmers motors.

Smaller in size than previous design, it retains the easy-to-clean, fin-type construction which Allis-Chalmers pioneered several years ago. The bearing design gives greater bearing protection, ease of maintenance and long life. Insulation gives you famous Allis-Chalmers rugged dependability.

Consult your nearby Allis-Chalmers Authorized Distributor or District Office on your motor needs. Or write for Bulletin 51B6210.



STATOR DOUBLE INSULATED—Stator laminations are welded across back for rigidity. Heavy varnished cambric insulation is inserted between phase windings. Wound stator is dipped several times in special insulating varnish of proved effectiveness and stamina, and baked after each dip. The Allis-Chalmers stator is both physically and electrically strong . . . thoroughly protected against moisture, heat and corrosion.



FIN-TYPE CAST-IRON FRAME — Proved by years of service. Cooling ribs are cast integrally with the yoke; air is blown over them without restriction. There are no enclosed external air passages to clog up with dirt and thereby ruin cooling efficiency. Radiating surface provides reserve cooling capacity for extra strenuous duty. Cleaning, if required, is a few moments work with an air hose, brush or vacuum cleaner.

Multiple bearing protection keeps grease in... keeps dirt out...permits relubrication in service

Extreme care has been taken to provide longest possible bearing life and lowest possible maintenance costs. The bearing itself is of double-shielded type, which allows controlled migration of grease in and out of the bearing to suit operating conditions. Yet bearing is protected against greatest cause of bearing trouble — overgreasing.

Close running clearances and double labyrinth seals between the shaft and outer bearing housings keep grease in the bearing and exclude dirt. Grease is kept out of the interior of the motor by a bearing cap with a long running clearance along the shaft. The cap is held tightly in place by hex head cap screws. Large grease chambers hold an ample supply of lubricant.

A-4363

ALLIS-CHALMERS

MILWAUKEE 1, WISCONSIN

PROGRESS IN Switchgear

Here's Basic Difference in Operators

ALLIS-CHALMERS uses simple uncoupling linkage for fully mechanically trip-free operation

Take the case of a high speed reopening following "closing-in" on a system fault. That's really the test! With Allis-Chalmers mechanism, air or oil pressure need not be dumped to permit opening. Trip coil releases a latch and the simple closing linkages uncouple, allowing contacts to open at full speed — regardless of the position or condition of the closing mechanism. That's fully mechanically trip-free operation!

Non-mechanically trip-free mechanisms require dumping of air or oil pressure so that contacts can open. To do this takes a whole sequence of devices, including valves and solenoids. Everything must work perfectly, or breaker will be held closed or slowed in opening.

This truly simple operator principle has been a feature of Allis-Chalmers breakers since 1933. For further details call your nearby A-C district office, or write Allis-Chalmers, Milwaukee 1, Wisconsin.

A-4391

A-C ALLIS-CHALMERS

ALLIS-CHALMERS

In a quiet room at Bell Laboratories an engineer scales off the distance between two condenser microphones during a calibrating test. Able to measure air pressure variations of a few billionths of an atmosphere, such microphones play a crucial role in the scientific study of telephone instruments.

SOUND STEPS ON THE SCALES

Those small cylinders facing each other are condenser microphones—measuring tools that play a vital part in making your telephone easier to hear and talk through.

They are being calibrated by an engineer at Bell Telephone Laboratories to give extremely accurate information on the kind of sound your telephone company handles. Armed with these vital fundamental data on what sound *is*, Bell Laboratories scientists devise the instruments and equipment that transmit it best.

At Western Electric, manufacturing unit of the Bell System, a condenser microphone "listens" as your ear would listen to every telephone before it goes into service. The condenser microphone is but one of many precise tools that Laboratories scientists have developed to make telephone service better and more economical.

BELL TELEPHONE LABORATORIES

Improving America's telephone service offers careers for creative men in scientific and technical fields.

75% SAVING... IN STORAGE SPACE WITH P-L ANCHORS

CONVENIENT CARTONS OF SIX
EASIER TO STORE AND HANDLE

P-L Earth Anchors offer another outstanding first to the industry . . . carton packaging with greatly added convenience and safety. Cartons contain six anchors, weigh about 50 pounds and will not roll. They are easily arranged into neat, compact stacks that save valuable warehouse space and speed up inventory control. P-L Anchors are ready to use when removed from the carton! No more unsightly, dangerous mounds of loose anchors when you specify anchors packed the modern way . . . the P-L Six-Carton way.

And P-L Earth Anchors are better. Test after test, in all types of soil in all sections of the country, prove there is a specific P-L Anchor for every soil condition. P-L offers the only complete line of earth anchors in both 2-way and 4-way types. Specify P-L Earth Anchors . . . the best anchors on earth.

Send for free sample anchor . . . P-L Selector Chart . . . literature and prices.

PL54-8

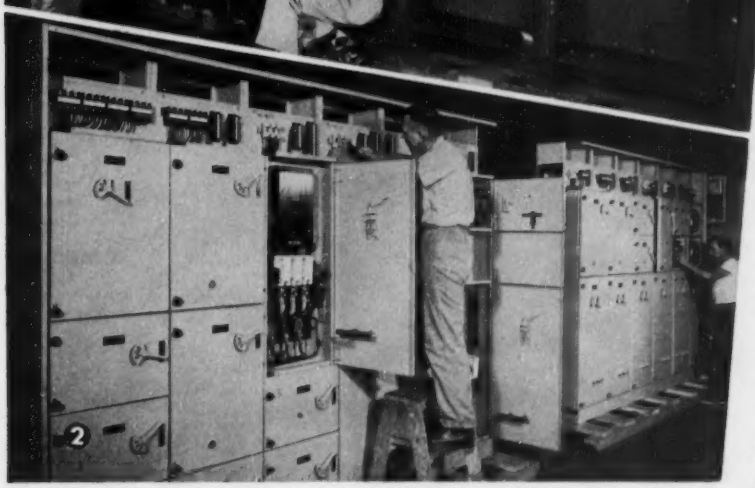
PIEPER-LILLARD, INCORPORATED

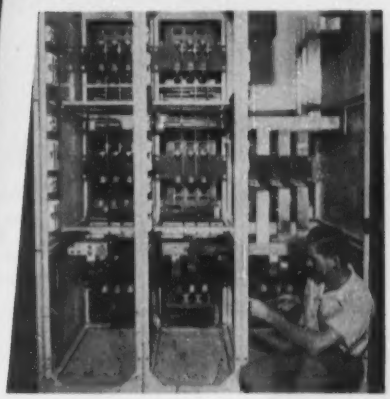
TELEPHONE YORKTOWN 5-4811 • 122 N. KIRKWOOD RD. • ST. LOUIS 22, MO.

ORIGINATORS OF THE BENDING HINGE ANCHOR

Visit OUR FACTORY!

No. 2 in a series of pictorial tours thru the Nelson Plant showing Nelson Electrical Equipment "in the making".





Wire harness is being connected to rear terminal blocks by this experienced workman. Assembly shown is rear view of Nelson Class 722, Low Voltage, Metal-Enclosed, Air Circuit Breaker Drawout Switchgear.

This Nelson inspector is carefully checking continuity of control circuit in Class 423, Explosion-Proof, Two-Speed, Combination Motor Starter.

❶ Top photograph shows hinge cable being run from cubicle to instrument door of Nelson Class 726, Standardized, Vertical Lift, Metal-Clad, Oil Circuit Breaker Switchgear.

❷ The excellent performance of Nelson Class 1035 Motor Control Centers is assured at our factory where each wiring operation is given scrupulous attention as shown above.

MANUFACTURERS OF: Instrument and Control Panels • Benchboards and Consoles • "Central" Motor Control Centers • Switchgear—low voltage and high voltage • Unit Substations • Motor Starters, Circuit Breakers, Lighting Panels, Control Stations and Junction Boxes in water-tight, dust-tight and explosion-proof enclosures • "Nelex" Mineral Insulated Heater Units

Write for a copy of our "Pictorial Index"

NELSON *Electric* MANUFACTURING CO.
TULSA, OKLAHOMA

RM POWER TRANSFORMERS

the benefits of ASA standards

RM* brings you all these benefits

Repetitive Manufacture gives you the economy of a standardized product, yet with optional ratings and accessories sufficient to meet most special needs. Ordering is simpler, shipment is many weeks faster, and prices are up to 8% lower than those of nonstandard units.

**RM is the G-E designation for ASA-standardized power transformers 69 kv and below, 501 through 5000 kva single-phase, and 10,000 kva three-phase.*

LOWER PRICE

plus . . . . . **Stronger liquid-tight tanks**

because submerged arc welding strengthens major tank joints

When you need a transformer in the medium range, order a Repetitive Manufacture transformer, and you'll get all the benefits of ASA standards plus many extra advantages that give you better performance, easier handling and less maintenance.

STRONG, LIQUID-TIGHT TANKS, for example, virtually end damage and leaks from shipment and handling. Tanks are stronger because submerged-arc welding, pictured at left, strengthens all major tank joints. In this new process now in use at General Electric's new Medium Transformer Plant, an electrode wire is fed into an arch which is submerged in the granulated flux material deposited ahead of the arc by the welding head. Uniform welding speed is maintained by a driver geared to this head.

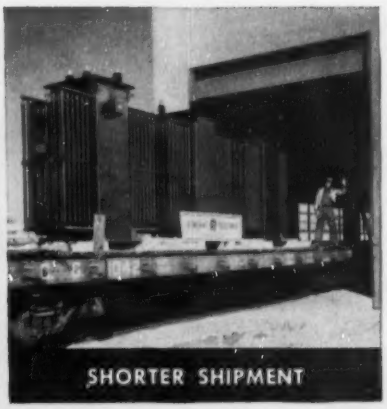
Developed by General Electric, this continuous welding process assures stronger, less brittle, more dependable welds of deeper penetration at major tank joints. Damage which can result from shipping and rough handling is minimized and tanks remain liquid tight.

MANY OTHER BENEFITS result from the advanced methods and processes used in General Electric's new plant at Rome, Ga. These include high dielectric strength because vapor-phase drying removes entrapped moisture; superior rust prevention because new Super Melaglyp paint finish lasts up to 150% longer; quicker delivery from faster, conveyorized production. Built solely to produce power transformers in the medium transformer range, this plant serves electric utilities and industry by turning out better products in a shorter time. You can get full information about RM power transformers by contacting your nearest G-E Apparatus Sales Office, or writing for Bulletin GEA-6108 to General Electric Company, Section 422-10, Schenectady 5, New York.

Progress Is Our Most Important Product

GENERAL ELECTRIC

SIMPLIFIED PURCHASING



SHORTER SHIPMENT

G.E.'s NEW ROME, GA., TRANSFORMER PLANT—built specifically to meet the growing trend to standardize power transformers.

ANOTHER MOTOROLA FIRST

NEW ALL TONE SUPERVISORY CONTROL

More Reliable Supervisory Control offers a further means toward optimum utilization of man-power and helps alleviate the problem of men "going stale" on the job.

Motorola's new supervisory control system for remote operation of unattended apparatus, places *centralized control* at your load dispatcher's fingertips. It optimizes system coordination and efficiency and helps sustain operating profit at a higher level.

Accurate and reliable functioning of terminal apparatus is assured by coded signals from and to the central dispatch console. This all tone system utilizes any audio channel with *maximum security*. The signals go through the entire system unchanged and do not require synchronization or adherence to close time tolerances.

Exclusive multiple selection and simultaneous operation of remote apparatus at one or several stations is optionally possible without additional equipment for selecting and operating the combinations.

EXCLUSIVE ALARM MEMORY CIRCUIT—The important flashing alarm indication will always remain on the specific escutcheon until cancelled by *pulling* main reset key even though alarm bell and light are cancelled by alarm reset, or other points on systems are selected, operated and reset.

The Add-a-Point feature makes adequate provisions for future expansion of the system. A full complement of wiring in each relay case at the start so that additional point functions can be added easily and economically.

Other Exclusive Features

Maximum security with precision tone control by exclusive Motorola Vibrasenders and Vibrasponders.

Selection with position verification before operation.

Selection cannot interfere with reception of alarm indications.

Predetermined priority reporting of multiple stations.

Inexpensive duplicate lamp display for distant points.

Motorola

Communications & Electronics, Inc.

A SUBSIDIARY OF MOTOROLA, INC.

4501 W. Augusta Blvd., Chicago 51, Illinois • Rogers Majestic Electronics Ltd., Toronto, Canada

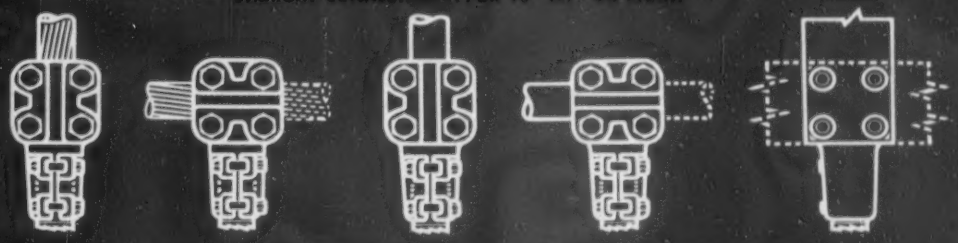
★ ABW DESIGN MEANS QUALITY *plus* STRENGTH in the RIGHT PLACES!

399* CONNECTION COMBINATIONS

with these new

ANDERSON UNIVERSAL STUD CONNECTORS... Types DSN & DSCT!

★ CABLE
★ TUBE
★ BAR



DSN . . .

5 stud sizes.
Cable sizes #6SOL through 2000 MCM.
½" IPS through 1½" IPS

DSCT . . .

7 stud sizes.
Cable sizes #2SOL through 800 MCM.
½" IPS through ¾" IPS.

* **HOW MANY CAN YOU COME UP WITH... WE STOPPED COUNTING AT 399!**

These new, versatile, multi-purpose connectors are ruggedly designed for tough service conditions . . . *and for wider application in a greater range of conductor sizes . . . cable, tube or bar!* The square conductor clamping cap permits 90° rotation, and is specially designed for minimum and maximum size conductors. They are cast of high-strength electrical bronze. Silicon bronze hex head bolts, nuts and lockwashers are furnished.

FOR MORE COMPLETE INFORMATION consult your nearest ABW representative or contact our home office.

ABW

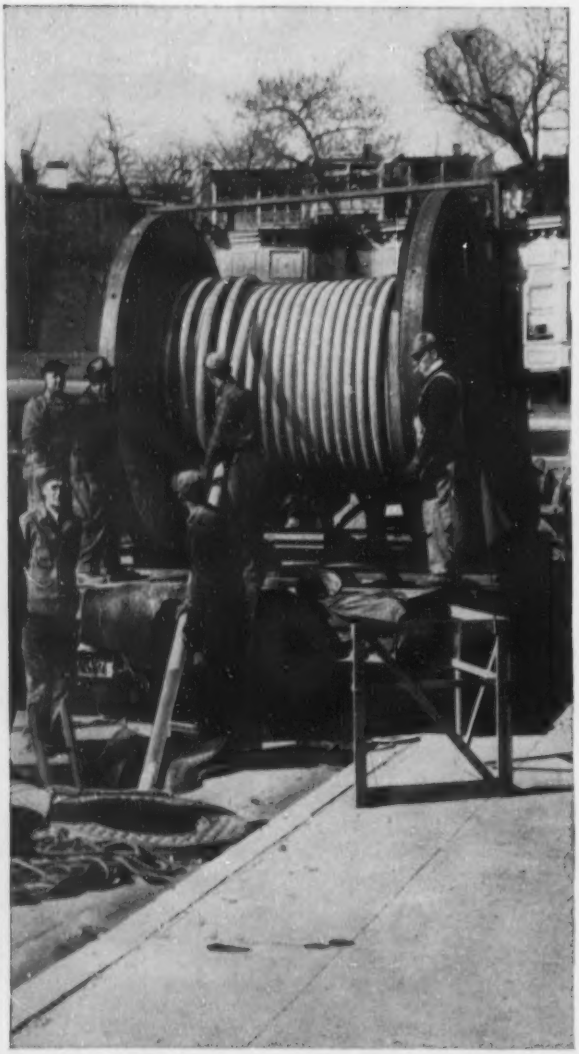
Aluminum & Bronze POWER CONNECTORS • CLAMPS • FITTINGS • ACCESSORIES
for SUBSTATION • TRANSMISSION • DISTRIBUTION SYSTEMS *for over a Quarter Century*

ANDERSON BRASS WORKS, INC.

P. O. DRAWER 2151 • BIRMINGHAM 1, ALABAMA

For a 4-mile 69 kv. installation—

Here's why Potomac chose NEOPRENE-



▲ **PULLING STRESS VARIED** from 3700 pounds to 6600 pounds. Longest "pull" was 809 feet. Light, flexible neoprene jacketing enabled crews to "pull" cable quickly, without any undue difficulty.

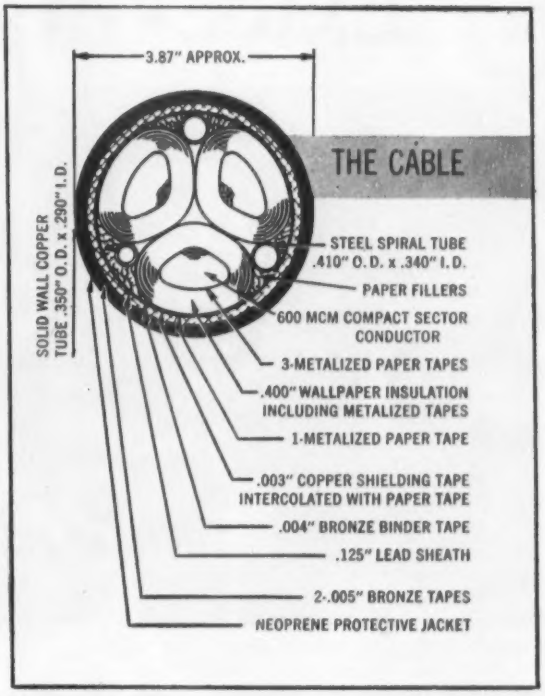
▲ **TWO 4-WAY LINES** make up basic conduit construction, spread 6'9½" on centers. Manholes are placed to serve two of the cables each, neither cable supplying the same terminal station.

Electric Power Co. jacketed cable

FOUR MILES separated Potomac Electric Power Company's new generating station from the area to be served. After studying all types of cable suitable for the transmission of 69 kv. over this distance, a neoprene-jacketed cable of unique design was selected. This was the first medium pressure gas-filled cable constructed for operation over 46 kv. It consisted of a 600,000 circular-mil compact sector design with 400-mil insulation, and an outer sheath of neoprene over an inner sheath of lead.

Tests proved this design to be most advantageous in terms of weight and space. This resulted in important savings in manhole widths and faster, easier pulls. And with neoprene's outstanding resistance to galvanic action and corrosion as well as to wear from cable movement, Potomac Electric's engineers knew they could look forward to a long service life for the cable with greatly reduced operating and maintenance costs.

ASK YOUR OWN SUPPLIER to tell you about neoprene-jacketed cables for use in ducts, above ground or buried directly in earth. He can offer you this cable in single and multi-conductor types for a wide range of voltage ratings. Buy neoprene-jacketed cable for your installations. You'll be satisfied . . . for a *long* time!


3.87" APPROX.
THE CABLE
SOLID WALL COPPER TUBE .350" O.D. x .290" I.D.
STEEL SPIRAL TUBE .410" O.D. x .340" I.D.
PAPER FILLERS
600 MCM COMPACT SECTOR CONDUCTOR
3-METALIZED PAPER TAPES
.400" WALLPAPER INSULATION INCLUDING METALIZED TAPES
1-METALIZED PAPER TAPE
.003" COPPER SHIELDING TAPE INTERCOLATED WITH PAPER TAPE
.004" BRONZE BINDER TAPE
.125" LEAD SHEATH
2-.005" BRONZE TAPES
NEOPRENE PROTECTIVE JACKET

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Rubber Chemicals Division EW-7
Wilmington 98, Delaware

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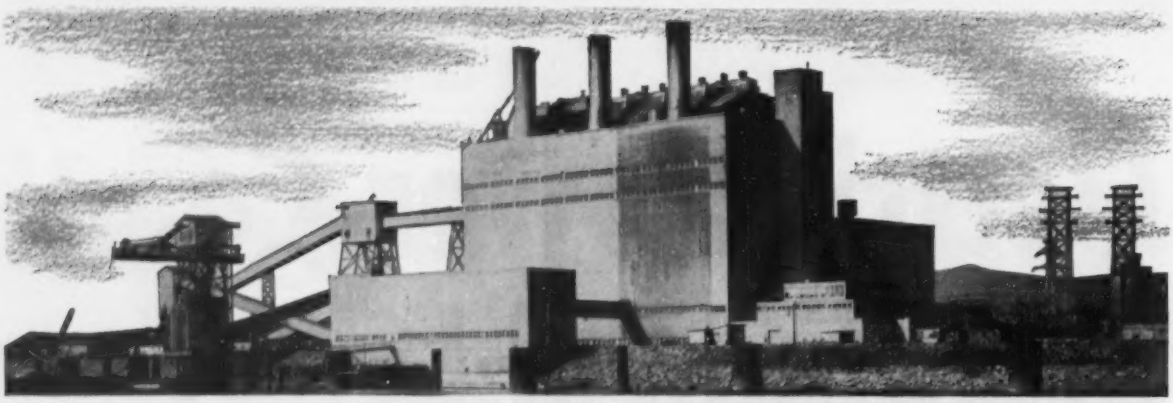
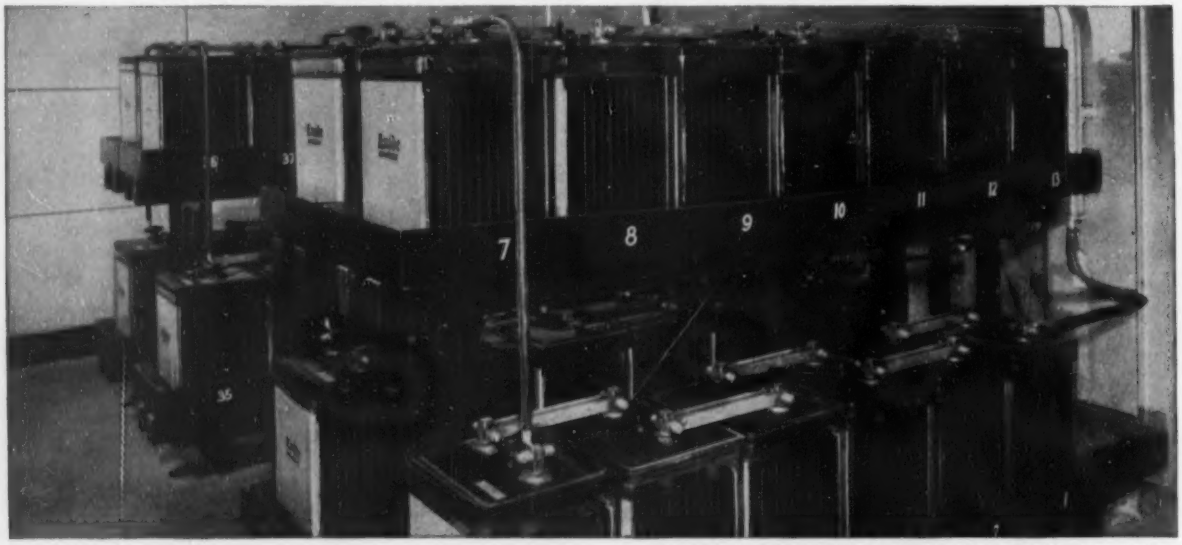


Modern, efficient and packed with power—the Elrama plant of Duquesne Light Company.

Pacing Industrial Progress—*Duquesne Light Company*

Exide®-Manchex® BATTERIES



Exide-Manchex FME-25 battery installation at the Elrama station.

Although Pittsburgh's electricity needs will continue to grow, Duquesne Light Company's newest power station will be a vital factor in meeting today's as well as future demands for electrical power. The Elrama plant, located on the Monongahela River, is the fifth in the Duquesne system. It has two 95,000-kilowatt units now in operation, with a third unit of 120,000-kilowatt capacity scheduled for completion in 1954. Duquesne Light Company's present expansion program will have added 91 per cent as much generating capacity as was installed in the 70 previous years of the company's history.

It is significant that Duquesne employs Exide-Manchex batteries; they assure:

POSITIVE OPERATION: Dependable performance at ample voltage avoids switchgear operational failures.

INSTANTANEOUS POWER: High rates for switchgear and valve operation with adequate reserve power for all other control circuits and for emergency lighting.

LOW OPERATING COST: Extremely low internal resistance.

LOW MAINTENANCE COSTS: Water required about twice a year. No change of chemical solution during life of battery.

LOW DEPRECIATION: Sturdy, long-life construction.

GREATER CAPACITY in a given amount of space avoids overcrowding.

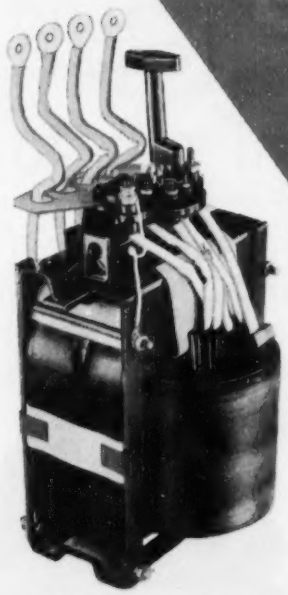
• • •

Various sizes and types of Exide Batteries are available in plastic containers.

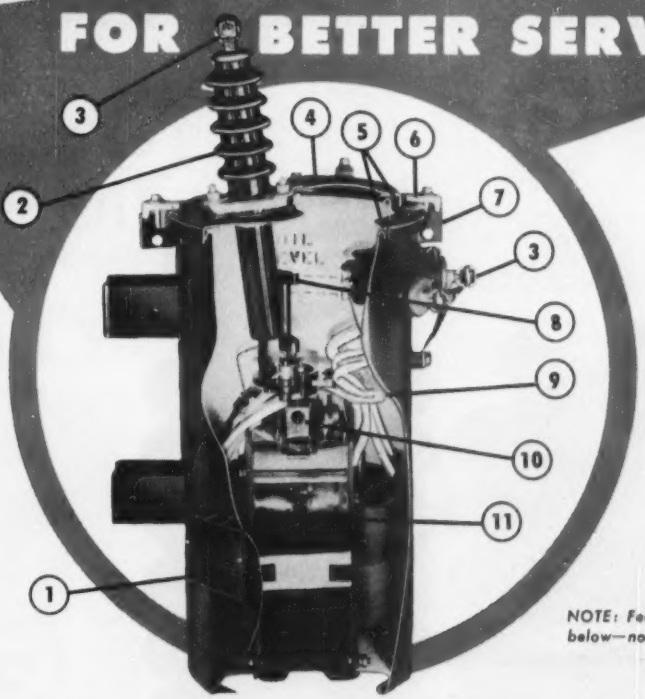
Exide-Manchex is your best battery buy for all control and substation services.

Exide INDUSTRIAL DIVISION, The Electric Storage Battery Company, Philadelphia 2, Pa.

Central DISTRIBUTION TRANSFORMERS FOR BETTER SERVICE!



10 KVA Core and Coil Assembly



NOTE: Features 12 to 18 listed below—not visible on illustration.

1. **Heavy Gauge Stainless Steel Name Plate with Bracket Designed for Easy Cleaning and Painting.**
2. **Externally-Clamped Primary Bushing, Galvanized Hardware, Shank Extending Into Oil.**
3. **Tin-Plated Bushing Terminals.**
4. **Large Oval Handhole.**
5. **Buna N Gaskets, Seal Assured by Rolled Edge Tank and Handhole.**
6. **Galvanized Cast Steel Cover Clamps.**
7. **Heavy Gauge Cover Holddown and Lifting Lugs.**
8. **Tap Changer Operating Handle Above Oil Level.**
9. **Low Voltage Spacer Board.**
10. **Combination Anchoring and Untanking Lug. Centering Boss in Base.**
11. **Cold-Rolled Grain Oriented Core Steel.**
12. **Folded Layer Insulation.**
13. **¼" Minimum Coil Ducts.**
14. **Coil Blocking, 15 KVA and Above.**
15. **Flexible Cable Secondary Leads, 25 KVA and Above.**
16. **Filled with Inhibited Oil Under Vacuum.**
17. **Tank Finish: Shot Blast, Primer and Two Finish Coats.**
18. **Coil Treatment: Coils are Baked after Impregnation with Heat Reactive Polymerizing Varnish.**

CTC

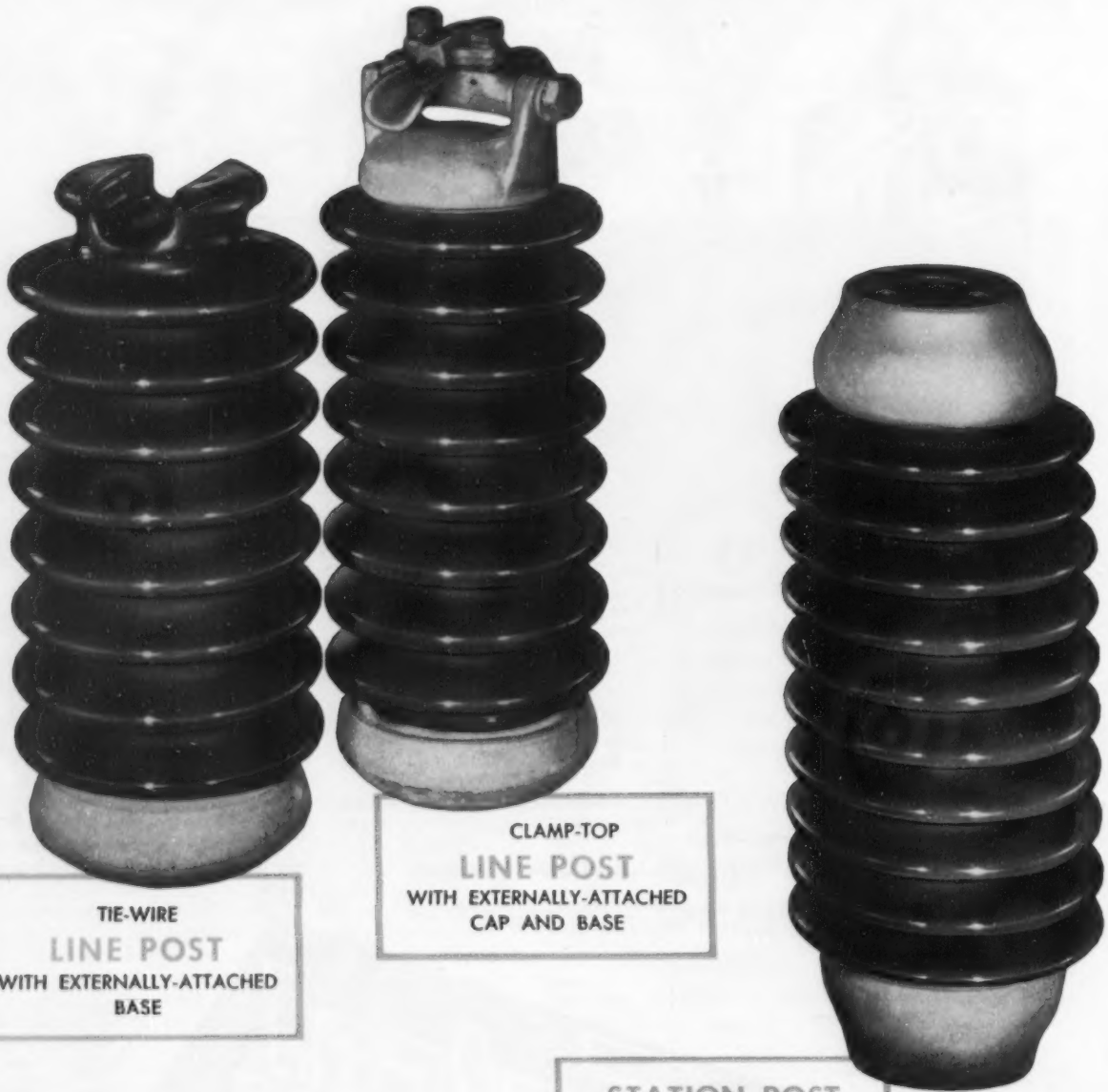
SALES OFFICES IN PRINCIPAL CITIES

Central TRANSFORMER CORP.

PINE BLUFF, ARKANSAS

NEMA

the only insulators..



TIE-WIRE
LINE POST
WITH EXTERNALLY-ATTACHED
BASE

CLAMP-TOP
LINE POST
WITH EXTERNALLY-ATTACHED
CAP AND BASE

STATION POST
WITH EXTERNALLY-ATTACHED
CAP AND BASE

. . . FOR TRANSMISSION LINE AND STATION USE . . .

built to take advantage of the inherent strength of porcelain

CHARACTERISTICS OF LAPP VACUUM-PROCESS PORCELAIN:

Specific Gravity	2.41
Density	.087 lbs. per cu. in.
Porosity	Zero
■ **Compression Strength**	**100,000 lbs. per sq. in.**
■ **Tensile Strength**	**5,000 to 8,000 lbs. per sq. in.**
Modulus of Rupture—Glazed	15,000 lbs. per sq. in.
Modulus of Rupture—Unglazed	10,500 lbs. per sq. in.
Linear Thermal Expansion	3.23×10^{-6} per °F, 0-600°F
Puncture Strength	
—3/8" Uniform Sections	250 Kv per in.
—1" Uniform Sections	170 Kv per in.
Dielectric Constant (1000 cycles)	6.33
Power Factor (1000 kilocycles)	.8%

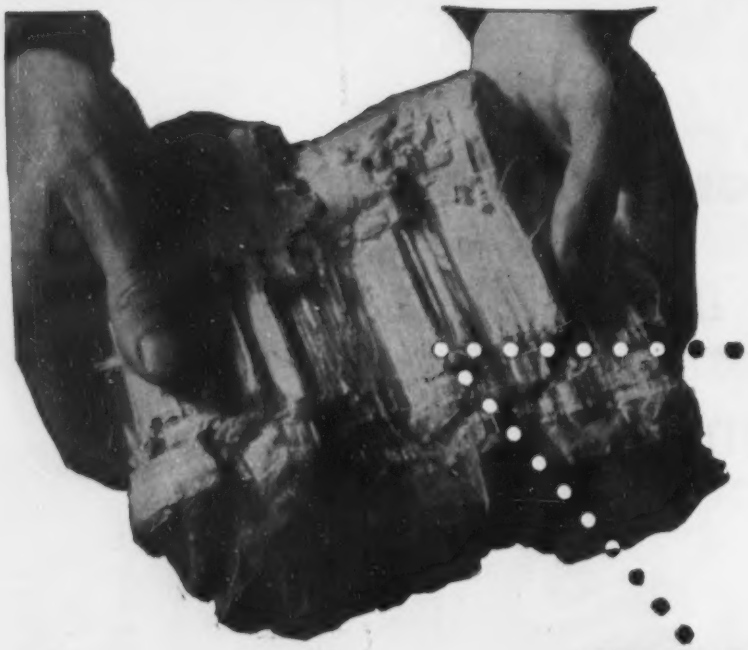
Cracking of insulator porcelain is characteristically and ultimately caused by tension-loading of the porcelain resulting from relative thermal movement. Any insulator of nested porcelain parts, with internal pins, or metal inserts, must be protected against cracking by extra-thick cushions of paint, or other devices of questionable mechanical security.

A fundamental concept from the beginning of the Lapp "Post" idea has been the *elimination of the causes* of such tension-loading. *No nested porcelain parts . . . no pins . . . no metal inserts.* All hardware is externally attached, so that porcelain can be loaded only in compression—in which it is from 12 to 20 times as strong as it is in tension.

Even in cantilever, the loading is distributed over the much larger, low-intensity area of gripping attachment, as compared with the relatively smaller-area higher-intensity loading on porcelains of insulators which have internally-attached pins or inserts.

You can specify Lapp Station Posts . . . Lapp Line Posts with conventional tie-wire head . . . or the new Clamp-Top Lapp Line Posts . . . with confidence in their extra margin of operating security, long life, and low upkeep. Lapp Insulator Co., Inc., LeRoy, N.Y.

Lapp



From the magic mineral

...ASBESTOS

come these strong, durable

TRANSITE DUCTS

made to stand the test of time..

Transite* meets every requirement of the ideal duct material. It is permanent, fireproof, corrosion resistant, strong, light in weight, smooth-bored, non-inductive, and has rapid heat dissipation. No protective coating is required. The 10-foot lengths are rapidly assembled. Transite will outlast other duct materials. Write for new, free brochure showing how J-M Transite Ducts can effect substantial savings in both installation and maintenance of cable subways. Address Johns-Manville, Box 60, New York 16, N. Y. In Canada, 199 Bay St., Toronto 1, Ontario.

Available In Two Types:

TRANSITE CONDUIT

Thick walled, used for exposed work, or buried without concrete casement saves time, labor, materials.

TRANSITE KORDUCT

Thinner walled for installation in concrete. Used for high-voltage lines, its high thermal conductivity cuts operating losses.

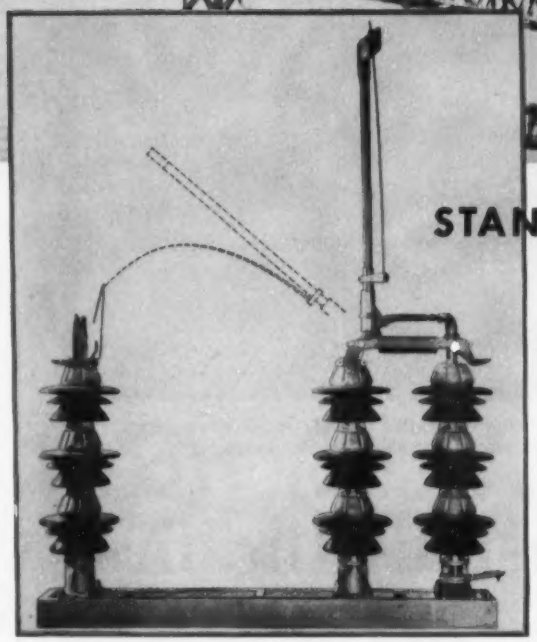
JOHNS-MANVILLE JM PRODUCTS

Johns-Manville

*Trade mark registered

Increase the usefulness of Air Switches with the

R&IE ARC RESTRICTOR



Here is a type TTR49 air switch with Arc Restrictor attached — showing the Arc Restrictor horn (dotted) retained by stationery horn at the point of release. As the blade opens further, the ultra-rapid travel of the Arc Restrictor horn quickly establishes a gap distance beyond that in which an arc can restrike.

The Arc Restrictor has been proven in the laboratory, and on power company lines in actual service. Tests during extreme heat and cold, ice and snow, have also proven the effectivenss of the Arc Restrictor.

STANDARD Type TTR49 SWITCHES with Quick Break Horns — Cuts switching and structure cost

Now you can open line charging currents, transformer magnetizing current and small load currents at voltages up to and including 161 kv — CUTS EXPENSIVE INTERRUPTING COSTS!

Reduces phase spacing of horn gap switches to disconnecting switch requirements. Due to little or no arcing when switching up to thirty or forty miles of line charging current — CUTS STRUCTURE COSTS.

CONVERT FROM CONVENTIONAL SWITCHING TO INTERRUPTER SWITCHING IN A FEW HOURS

Arc Restrictor parts can be easily attached to existing vertical or side break switches — or can be ordered with new switches. Inspection is no more problem than that for any air switch.

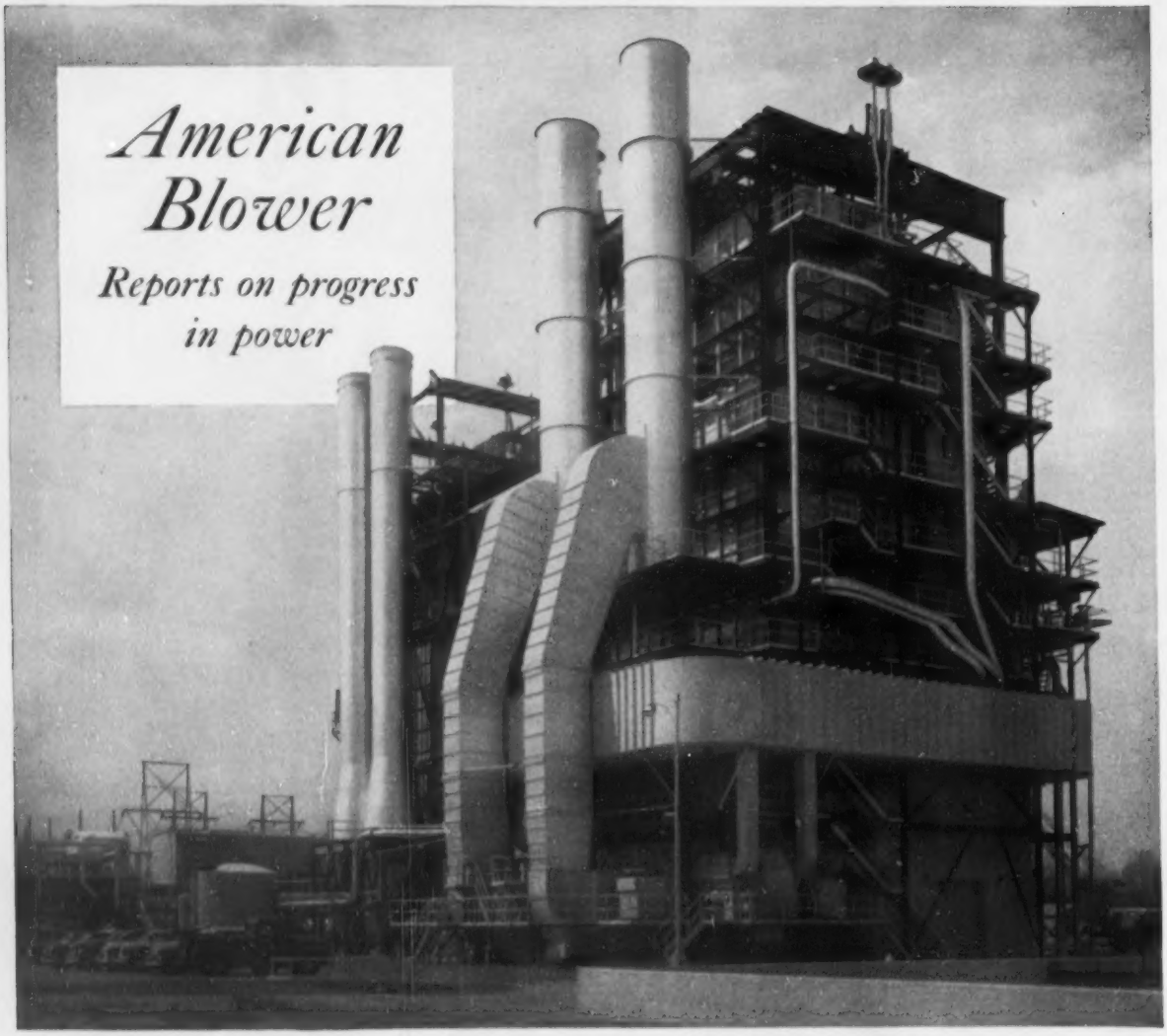
Consult the R&IE Equipment Division representative about test data and demonstration films available.

●

R&IE SWITCHING EQUIPMENT
DIVISION OF I-T-E CIRCUIT BREAKER COMPANY
GREENSBURG, PENNA.

STRUCTURES—steel or aluminum ● TESTING DEVICES ● KIRK KEY INTERLOCK SYSTEMS ● ISOLATED PHASE BUS STRUCTURES ● INTERRUPTER SWITCHES

INDOOR BUS SUPPORTS and BUS FABRICATION ● OUTDOOR BUS SUPPORTS and AIR SWITCHES ● SUBSTATION



● Up-to-date Ninemile Point Plant, near New Orleans, will have 310,000 kw capacity, when a third steam generating unit is completed in 1955. LP&LC's other steam-electric plant, Sterlington Station, has 146,000 kw capacity.

Louisiana Power installs the first

American Blower plays an important role in the LP&L Co. expansion program

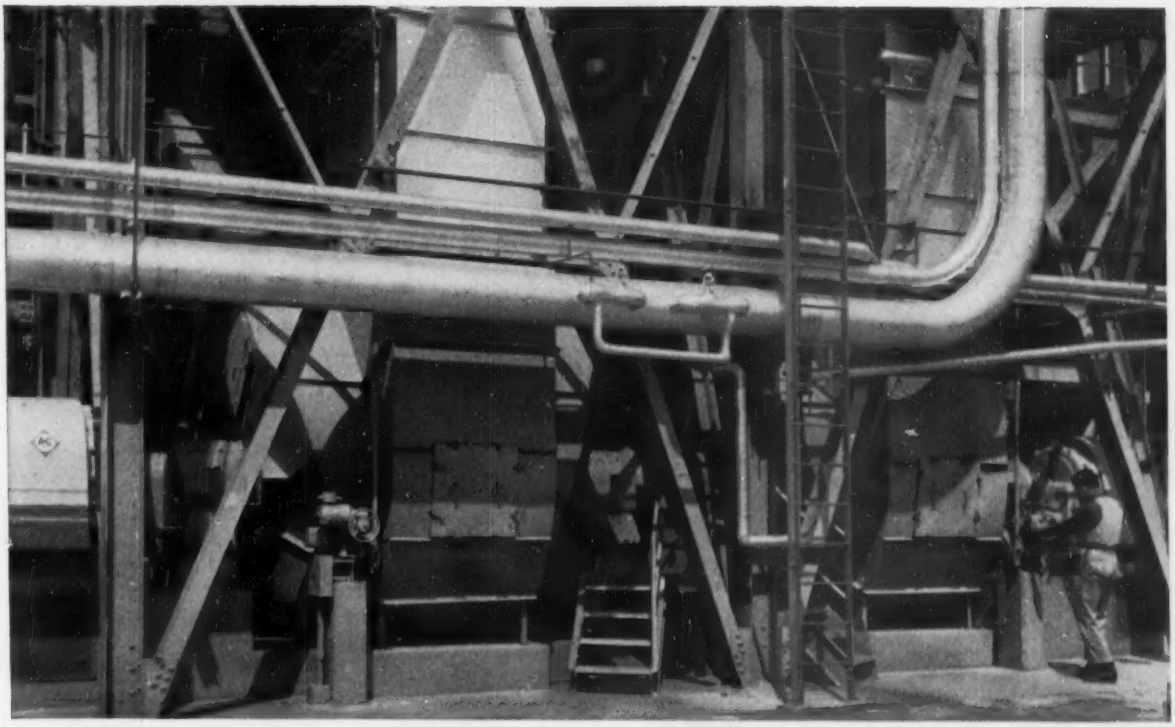
Scheduled for completion in early 1955, the third unit of Louisiana Power & Light Company's Ninemile Point Plant will be the first gas-fired unit in the country to employ the reheat cycle. By re-heating steam in the boiler after it has done part of its work in the turbine, the reheat cycle promises fuel savings and greater operating efficiency!

The new unit will boost capacity at Ninemile Plant to 310,000 kw. Its boiler will stand 14 stories high, have a high-speed elevator for rapid access to all operating levels and will be capable of producing 1,000,000 lbs. of steam per hour at a pressure of 1,525 pounds per square inch at 1,005° F.

Another unique feature at Ninemile Point Plant will be the commercial use of television for supervising the burning of natural gas in the boiler furnace. The control room operator will be able to light, adjust and control the furnace gas burners without leaving his station!

American Blower Forced and Induced Draft Fans

Serving home and industry: AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS & WALL



Two American Blower Induced Draft Fans are installed in the Ninemile Point Plant. Each has capacity of 143,500 cfm at 695 rpm with 8.3" sp. Driving power required is 319 hp.

This is one of two American Blower Forced Draft Fans at the Ninemile Point Plant. Each has a capacity of 78,000 cfm at 9.07" sp when operating at 1160 rpm requiring 164 hp.

gas-fired unit with reheat cycle!

have played an important part in LP&LC's expansion program. American Blower also makes Dust Collecting Equipment, Fly Ash Precipitators and Gyrol Fluid Drives for boiler feed pump and fan control.

If you plan to modernize or expand your facilities, talk over your problems with any American Blower engineer. His knowledge of the application of air-handling equipment and Gyrol Fluid Drives can prove invaluable to you. Contact your nearest American Blower Branch Office, or write us direct.

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO
Division of American Radiator & Standard Sanitary Corporation

AMERICAN BLOWER

TILE • DETROIT CONTROLS • KEWANEE BOILERS • ROSS EXCHANGERS • SUNBEAM AIR CONDITIONERS

GET THESE 4 BIG PLUSSES WITH PREFORMED ACCESSORIES

Since the inception of electrical transmission, many diversified devices have been designed and used on conductors and strand for dead-ending, guying, splicing, repairing and amoring. But until the Preformed Rod* was invented, there was no ONE principal way of doing all these jobs simply, easily and without tools. In addition, Preformed Accessories assure these FOUR BIG PLUSSES over ordinary accessories:

1 QUICKER INSTALLATION:

Preformed Accessories are quickly and easily applied by hand. No tools, clamps, clips, bolts or nuts are required. For example, field records of one large Western Utility show that dead-ending guys the Preformed way saves approximately 50% in labor . . . saves at least 20% in material.

2 "VELVET-GLOVE" GRIP:

Only Preformed Accessories assure the maximum in large-area, low-radial-pressure contacts without any concentrated pressures. These devices are not compression fittings; their PREFORMED spiral pitches tightly and snugly grip the conductor or strand with a UNIFORM lasting fit that never loosens.

3 LONGER CONDUCTOR LIFE:

Preformed Accessories banish lightning pitting or arc-over of conductors at or near support points . . . substantially reduce conductor stress to minimize vibration fatigue . . . prevent wear by chafing or fretting. Preformed Accessories assure the longest satisfactory transmission and distribution line life.

4 NEATER APPEARANCE:

Preformed Accessories are just as neat as the conductor or strand to which they are applied. In appearance, they are just another layer of the conductor or strand. Their smooth contour blends so well into the overall assembly that they can hardly be seen from a distance of a few feet.

PROGRESSIVE IDEAS . . . backed by EXTENSIVE RESEARCH and SOUND ENGINEERING insure the ultimate in FIELD PERFORMANCE

PREFORMED LINE PRODUCTS COMPANY

5349 ST. CLAIR AVENUE, CLEVELAND 3, OHIO

TELEPHONE CLEVELAND EXPRESS 1-3571

1

ARMOR RODS

are for reinforcing the conductor and protecting it from damage caused by vibration, chafing, arcover, concentrated clamp and tie-wire stresses, etc.

2

LINE GUARDS

of Metal protect conductors against clamping and tie-wire damage or arcover burning where vibration isn't a serious problem. Either metal or plastic Line Guards are ideal for protection of covered wires against abrasion.

3

"ALUMINUM-GRIP" DEAD-ENDS

make it easy to dead-end the bare-neutral or covered types of service drops both at the house and at the pole. These dead-ends assure low first cost, easy application and a neat appearance where it counts most.

4

PREFORMED "GUY-GRIPS"

assure the fastest, most economical and most efficient means of dead-ending guys . . . save about half the steel strand usually required . . . will not slip . . . are stronger than the strand itself.

5

PATCH RODS

are designed to restore the strength and full conductance to aluminum and ACSR conductors where damage does not exceed 25% of the outer strand layer.

6

PREFORMED LINE SPLICES

average 40% more conductivity than the unbroken conductor and are stronger than the original conductor.

7

DEAD-ENDS

The legs of a PLP Dead-End, when wrapped around conductor or strand, either bare or covered, assure a gripping strength great enough to break the strand or conductor without slippage.

8

TAP ARMOR

These short lengths of Preformed Rods eliminate troublesome concentrations of stresses . . . prevent arcing damage to the conductor . . . and guard against loosening of the tapping clamp.

* Preformed Armor Rods are manufactured under Patent Nos. 2,275,019 and 2,587,521 . . . other patents pending.

SALES REPRESENTATIVES

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Hotpoint

widens the source of utility revenue with Electric Ranges for every requirement

Custom-Sectionalized Range

Super De Luxe 39-Inch Lighted Pushbutton Range

Super-30 De Luxe Lighted Pushbutton Range

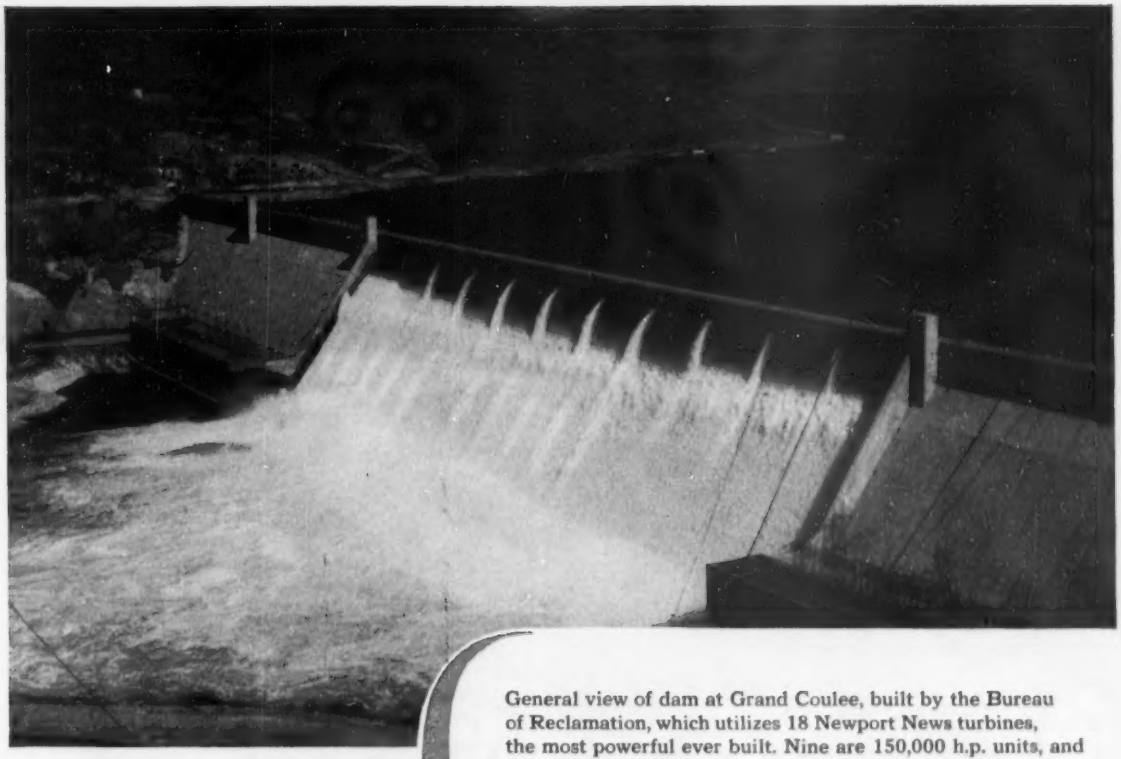
Hotpoint's complete line of 30- and 39-inch ranges, plus a modern custom-sectionalized line means that no matter what special requirement exists, or what range price the lady desires . . . Hotpoint has it.

Two fine new lines have been added to complement Hotpoint's line of highest quality 39-inch ranges. The Super-30 line and the Customline will be welcomed by thousands who will become new customers for electrical energy. The 3 new Super-30's at prices to fit every budget prove that saving space doesn't require sacrificing the wonderful de luxe features of larger Hotpoint models. The Hotpoint Sectionalized Custom Ranges provide an entirely new concept for modern kitchens, combining flexibility of design, efficiency, and economy.

Learn the full story on this Hotpoint Range line from your Hotpoint distributor. See how Hotpoint is opening up new horizons for utility revenue.

Again Hotpoint *looks at Tomorrow, Today*

HOTPOINT Co. (A Division of General Electric Company) 5600 West Taylor Street, Chicago 44, Illinois



General view of dam at Grand Coulee, built by the Bureau of Reclamation, which utilizes 18 Newport News turbines, the most powerful ever built. Nine are 150,000 h.p. units, and the other nine are rated at 165,000 h.p. each.

Specialists ... in building Water Power Equipment

Typical Users of Newport News Equipment

PLANT	LOCATION
Boone	Tennessee
Buchanan	Texas
Caonillas	Puerto Rico
Chief Joseph	Washington
Clark Hill	South Carolina
Deer Lake	Newfoundland
Folsom	California
Fort Patrick Henry	Tennessee
Hiwassee	Tennessee
Hoover	Nevada
J. H. Kerr	Virginia
Jim Woodruff	Florida
Lower Salmon	Idaho
Norris	Tennessee
Rock Creek	California
Santee-Cooper	South Carolina
C. J. Strike	Idaho
Whitney	Texas
Wilson	Alabama

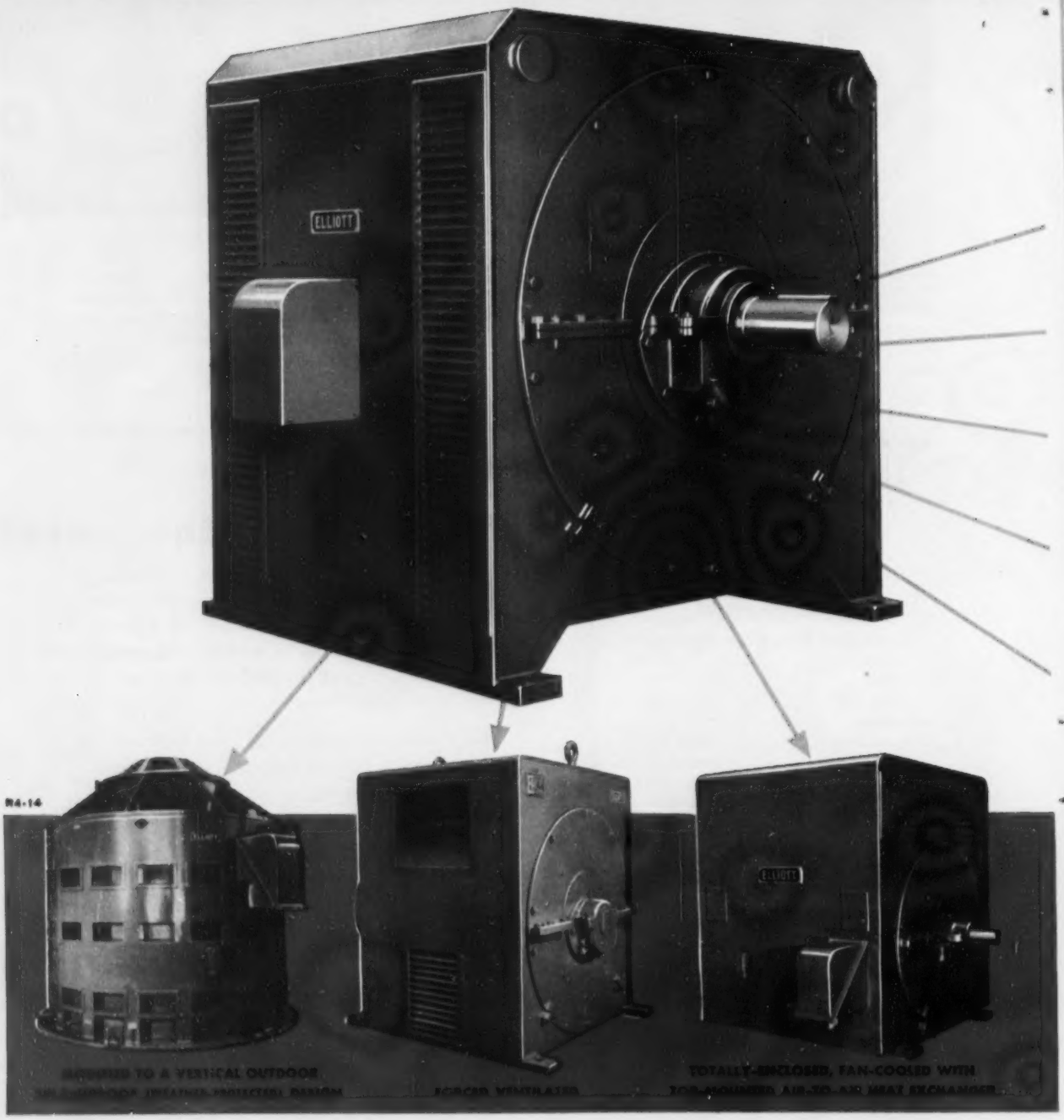
Turbines designed and built for the world's largest development at Grand Coulee... and for other hydroelectric installations in America and various parts of the world... bespeak the skill and facilities offered by Newport News.

This trained organization has filled hydroelectric turbine contracts with an aggregate rated output of 7,000,000 horsepower.

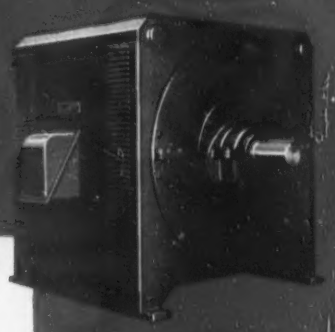
Other equipment designed and built by Newport News includes penstocks, pressure regulators, valves, pumps, gates and rack rakes. Upon request, a copy of our illustrated booklet entitled "WATER POWER EQUIPMENT" will be sent to you.

Newport News
SHIPBUILDING AND DRY DOCK COMPANY
Newport News, Virginia

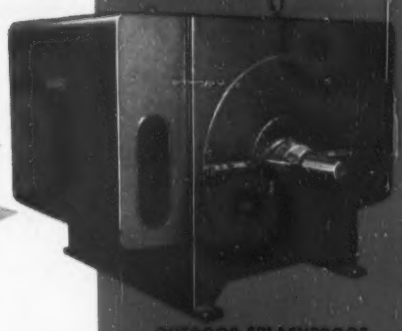
With ELLIOTT "fabri-steel" you *take your choice*



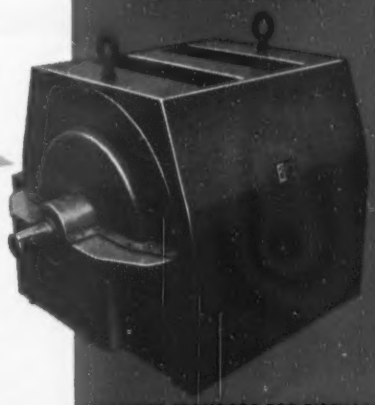
motor construction of enclosures



INDOOR SPLASHPROOF



OUTDOOR SPLASHPROOF
(WEATHER-PROTECTED)



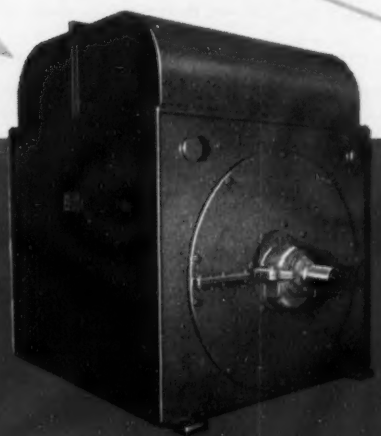
SHOUTED FRAME FOR TOP DISCHARGE

Without change in electrical design, an Elliott Fabri-Steel motor can be provided with the enclosure required by the application. To illustrate, here is a standard Elliott drip-proof squirrel-cage induction motor, and below it the wide variety of enclosures, each adapted to special conditions, in which the same motor can be obtained.

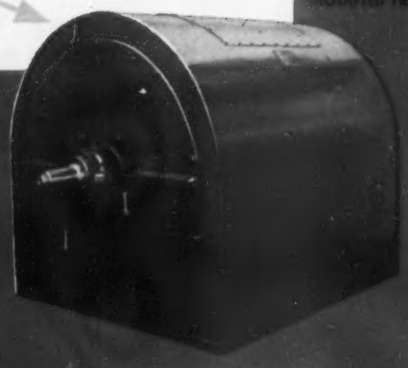
The answer is Elliott Fabri-Steel construction—actually tailoring in metal—which combines the crack-proof strength of steel with the extreme rigidity of skillful fabrication. It's the modern way to build large motors, now recognized throughout industry, with a ready adaptability to enclosure variation impracticable by other means.

For full data on Elliott "Fabri-Steel" motors, contact your local Elliott representative or write Elliott Company, Ridgway Division, Ridgway, Pa.

ELLIOTT Company
RIDGWAY DIVISION
FOR MOTORS 1-200 HP: CROCKER WHEELER DIV. AMPERE, N. J.



INERT-GAS OR INSTRUMENT-AIR-COOLED MOTOR WITH TOP-MOUNTED COOLER



ENCLOSED SELF-(BASE) VENTILATED

Elliott FABRI-STEEL

Here's large caliber ammunition for your adequate wiring fight

compliments of Kennecott!

Kennecott aims an all-out barrage against inadequate wiring! The enemy . . . weak, overloaded household circuits . . . is on the run!

The strategy: Every month this year Kennecott explodes a full page advertisement such as the one across the way. A total of 15,130,000 readers of the Saturday Evening Post and This Week are told why broilers don't broil, toasters don't toast, living room lights are forever dimming on and off.

Here at last is a logical, common-sense appeal to the 80% of the homeowners in your territory whose homes need larger sized wires, more circuits and outlets . . . and need them today.

It's a straightforward, educational campaign that's bound to benefit everyone in the electrical industry!

Tie-in with Kennecott!

This is a made-to-order opportunity for you to key your own local promotions to a hard-hitting national broadside! Write Kennecott for advertisement reprints and poster-size blow-ups for mailings and displays: Address your letter to Carl Lenz, President Kennecott Sales Corporation, 161 East 42nd Street, New York 17, N. Y.

HOORAY! Now his TV set always shows full-sized pictures!

Why couldn't it do that before?

No, there was nothing wrong with this gentleman's TV set. It just wasn't getting enough *electricity*. Because the *wires* in his house were too small . . . too weak . . . to carry a full load of current. So, when he switched on other appliances, his TV picture shrank in size!

But, he *did* something about it . . . had his wiring inspected, corrected. Now he gets full-powered, *full-sized* TV pictures all the time!

Put *yourself* in this man's place. Chances are *your own* TV set . . . your many other appliances, too . . . may not be getting the power they need to run as well as they can. You may be paying out good money for *wasted current*. You might be *risking fire* from undersized, overloaded, overheated wires!

At least, these things are happening today to over 80% of all American homeowners!

So, if you suffer from appliance troubles . . . if your lights often flicker and dim . . . if fuses keep blowing out or circuit breakers keep tripping . . . if you don't have enough outlets where they are needed . . . then *look to your wiring!* Talk it over with your electrician!

LOOK TO YOUR ELECTRICITY!

If you own a house, see your electrician. He will gladly make a study of your wiring system, tell you what work if any may be needed, and its cost.

If you plan to buy a house, don't forget to check up on the age and capacity of its wiring. Better still, have an electrician inspect it for you!

If you are going to build, be sure to plan your wiring for the *future* as well as the present. Remember that, on the average, your electrical needs increase 10% every year!

Kennecott Copper Corporation
161 E. 42nd St., New York 17, N. Y.

Published for your information by

Kennecott
COPPER CORPORATION

Fabricating Subsidiaries: CHASE BRASS & COPPER CO. KENNECOTT WIRE & CABLE CO.

This advertisement, appearing in SATURDAY EVENING POST and THIS WEEK, will reach more than fifteen million readers. It is only one of a regular series of Kennecott advertisements aimed at educating the public to the importance of adequate home wiring.

Silly, but

Who'd be silly enough to stick a finger in an open socket?
That's right, no one—but you'd be shocked at the number of people
who are equally careless with their best friend and servant, electricity.

Short circuits, blown fuses and burned out appliances are a daily occurrence
in every community. And minor disasters are all too frequent, too
. . . the electric range that won't heat up fast enough, the washing machine motor
that hums but won't turn over, the TV picture that fades away . . .

This is the dirty work of *inadequate wiring*—chronic illness
of more than 40 million American homes.

shocking . . .

It's not only the hazard—although that deserves your most serious consideration.
But think of all the inconvenience, too. The living room with only one outlet
—a booby trap of 3-way plugs, extension cords . . . pull out the clock,
plug in the radio. A bathroom with no outlets.
Throw away the electric shaver Aunt Hattie gave you for Christmas.
Like to vacuum the car? What, no outlet in the garage?

How adequately wired is *your* home? Or that new house you're thinking of buying?
Talk to your electric light and power company—get their counsel.
No, they don't have anything to do with the wiring *inside* your home, but they are concerned
with how economically and efficiently you utilize the electric power
they deliver to your meter. Or, if you prefer, write us for your
free copy of *"Getting the Most From Your Home's Electric System."*

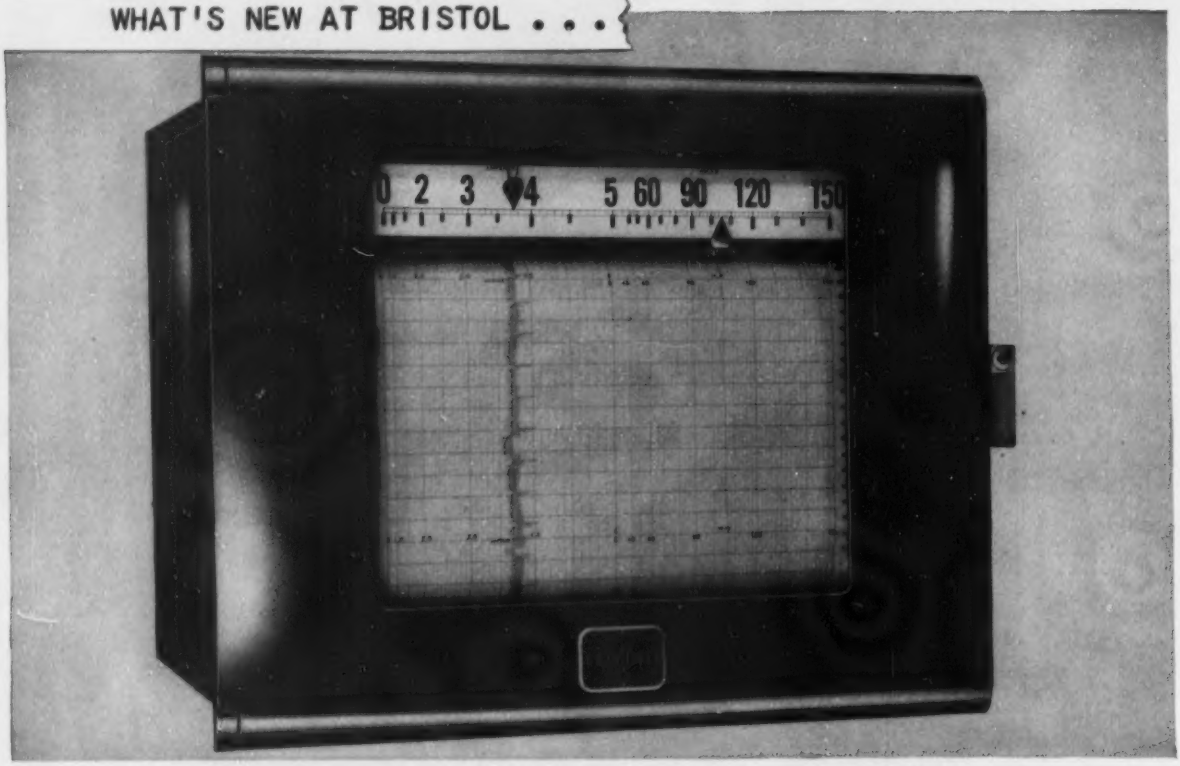
Electrical World

ADEQUATE WIRING SERVES AND SAVES

This message is the third in a series currently appearing in magazines reaching more than a million readers — businessmen and homeowners. It is sponsored by Electrical World for the most unselfish-selfish reason — what is good for the electric power industry is good for the publication that has served it continuously for 80 years.

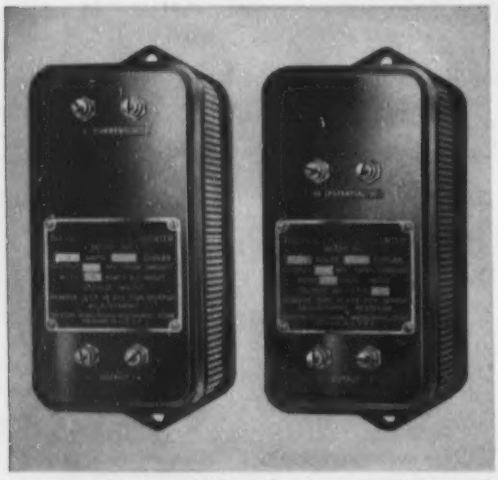
A McGRAW-HILL PUBLICATION, 330 WEST 42ND STREET, NEW YORK 36, NEW YORK • ABC • ABP

WHAT'S NEW AT BRISTOL . . .



Record current and voltage on one chart

with Bristol's Electronic Dynamaster Recording Voltmeter-Ammeter



THERMAL CURRENT and thermal voltage converters used with the Dynamaster Recording Voltmeter-Ammeter.

This two-pen strip-chart potentiometer records voltage and current simultaneously on the same chart. Measurements are made from a thermal voltage converter and a thermal current converter — a-c/d-c transducers with extremely high response speeds.

Here's what you get in this voltmeter-ammeter:

Accurate measurement: The Dynamaster is an accurate electronic instrument of simple, rugged construction. It is well suited for central station use under severe operating conditions, as well as for research and laboratory use.

Fast response: 2 seconds for full range pen travel. Every variation is recorded. Measurement is continuous.

Improved chart record: Two-zone, 12-inch strip chart with 11-inch calibrated width. Records are side-by-side — easy to read and compare, with expanded scales in the operating ranges. Chart speeds from ¾-inch per hour to 4-inches per second.

Kilowatt and Kilovar recorder: The Dynamaster is also available, using Bristol Thermoverter Transducers (thermal watt converters) as the primary elements, for recording watts and vars on a single two-zone chart.

Write for more information to The Bristol Company, 116 Bristol Road, Waterbury 20, Conn. 4.31

BRISTOL

POINTS THE WAY IN HUMAN-ENGINEERED INSTRUMENTATION

AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS

connections by

BURNDY

NORWALK, CONNECT. FACTORIES: NEW YORK, CALIFORNIA, TORONTO TORONTO, CANADA

EXPORT: PHILIPS EXPORT CORPORATION 54-2

NEW UTILITY STATIONS C-E EQUIPPED

Includes stations placed in operation since the war (in white) and those under construction or being engineered.

TIDD • JENNISON
CECIL LYNCH • HAVANA
MEREDOSIA • PERMIAN BASIN
O. H. HUTCHINGS • REX BROWN
HICKLING • B. C. COBB
RUSSELL • SEWAREN
POSSUM POINT • CUTLER
PORT JEFFERSON • WHITE RIVER
POTOMAC RIVER • GADSDEN
W. SPRINGFIELD • WOOD RIVER
DAN RIVER • LAKE CATHERINE
HARRY NEWMAN • JIM HILL
HUTCHISON • YATES
DUNKIRK • TITUS • LEE
CONTRA COSTA • HAWTHORN
NINEMILE POINT • EDGE MOOR
PALATKA • JOHNSONVILLE
DANSKAMMER • BECKJORD
HIGHGROVE • PLANT X
BLACK DOG • ALBANY
JOPPA • MERAMEC
PORTSMOUTH • LAKE CREEK
ETIWANDA • AURORA
HENNEPIN • EASTLAKE
OAK CREEK • SUWANNEE RIVER
URQUHART • KINGSTON

MULLERGREN

SANDOW
BARRY
NORTH OMAHA
SAGUARO
MILLIKEN
WILMINGTON
JOHN SEVIER
VERMILION
GALLATIN
BARRETT
CARBON

NEW ARTHUR

goes into service

Designed to serve as the heart of its expanding electrical network, Unit No. 1 of Western Light & Telephone Company's new Arthur Mullergren Station was placed in service recently near Great Bend, Kansas. A duplicate unit is planned for operation in 1955. Sargent & Lundy, Inc., are the consulting engineers.

Strategically located close to fuel, water and transportation in the center of the company's system, this new station's output will be available to 157 cities and towns in west-central Kansas.

The plant is partially enclosed. Turbo-generator, control equipment and offices are housed in a brick building of pleasing and substantial appearance, with the south wall of less permanent construction to facilitate planned expansion. The boiler is of the modern "outdoor" design, which effected a considerable saving in building cost.

The new 16,500-kw turbine-generator, largest of the system, is served by a C-E Vertical-Unit Boiler, a cross-sectional elevation and brief description of which appear on the opposite page.

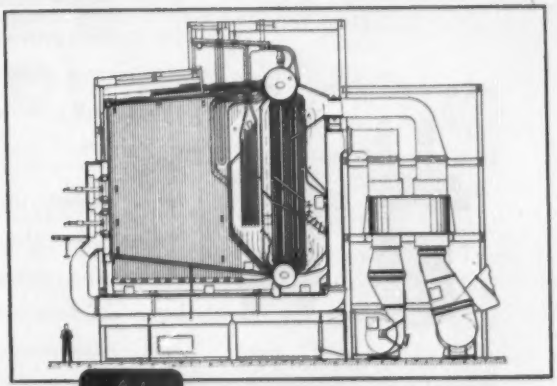
B-765

COMBUSTION

Combustion Engineering Building
200 Madison Avenue, New York 16, N. Y.

MULLERGREN STATION

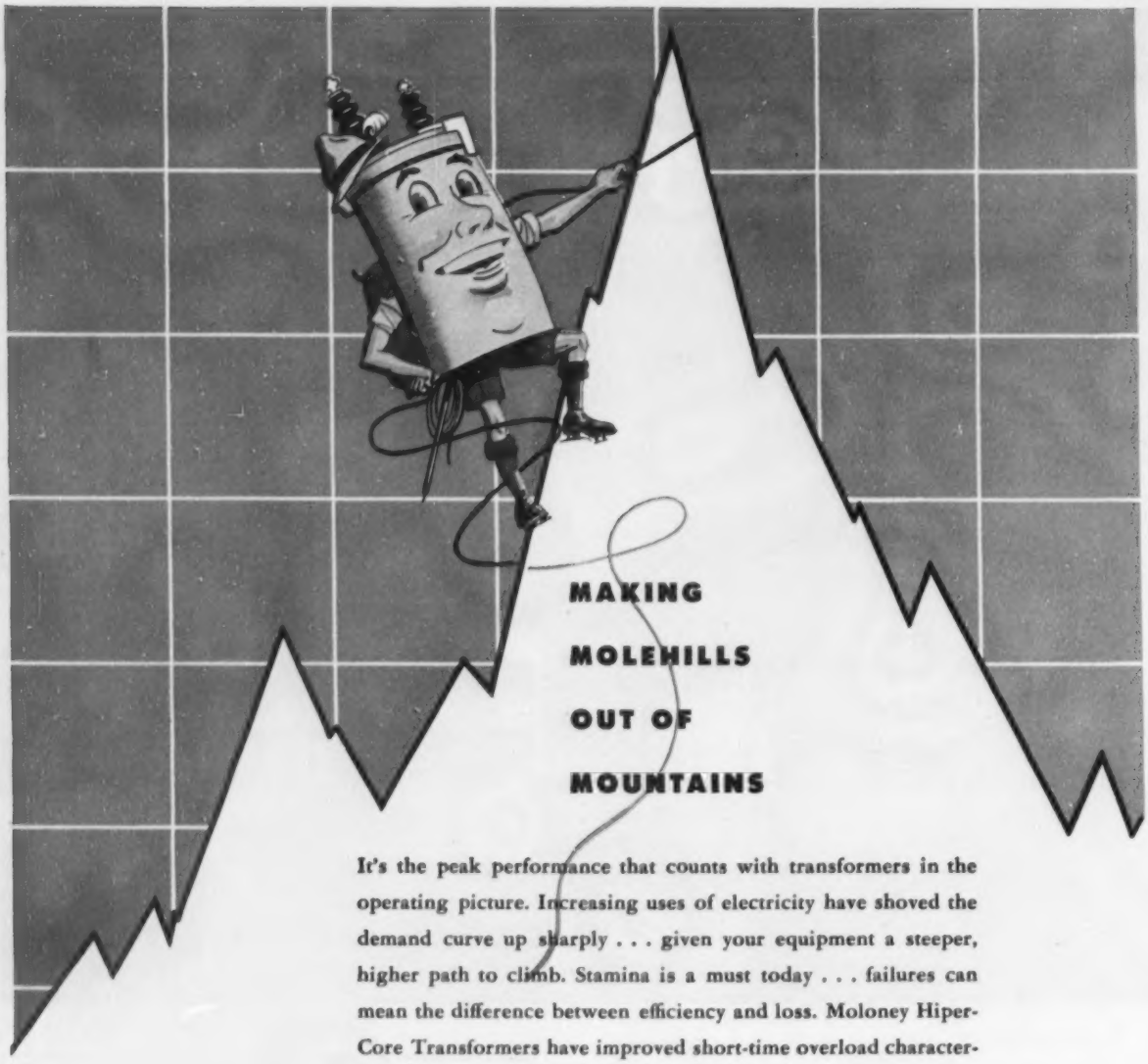
The C-E Unit shown at the right is now in service at the new Arthur Mullergren Station. It is a C-E Vertical-Unit Boiler. Type VU-50X, equipped with a 2-stage superheater, and has a regenerative type air heater following the convection surface. The unit is horizontally fired with natural gas, with provision to use oil as an alternate fuel. Maximum continuous capacity is 170,000 lb of steam per hr at 875 psi and 910 F.



C-E

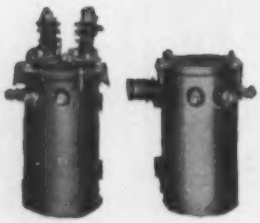
ENGINEERING

BOILERS, FUEL BURNING & RELATED EQUIPMENT; PULVERIZERS, AIR SEPARATORS & FLASH DRYING SYSTEMS; PRESSURE VESSELS; AUTOMATIC WATER HEATERS; SOIL PIPE



MAKING MOLEHILLS OUT OF MOUNTAINS

It's the peak performance that counts with transformers in the operating picture. Increasing uses of electricity have shoved the demand curve up sharply . . . given your equipment a steeper, higher path to climb. Stamina is a must today . . . failures can mean the difference between efficiency and loss. Moloney Hiper-Core Transformers have improved short-time overload characteristics which provide excellent peak load performance. Their design also permits rapid cooling, promotes longer operating life . . . in short, peak performance.



Moloney HiperCore Distribution Transformers are available from stock in all standard ratings from 3 Kva up in both Conventional and CSP designs.

It is not surprising that Moloney Transformers offer more . . . for each is really the product of 58 years of experience. The mark of Moloney has alway meant transformers built with the best in engineering, workmanship and materials. To make your system better . . . make it Moloney all along the line.

MEB4-11

MOLONEY ELECTRIC COMPANY

Manufacturers of Power Transformers • Distribution Transformers • Load Ratio Control Transformers • Step Voltage Regulators • Unit Substations • Electronic Transformers

SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT ST. LOUIS 20, MISSOURI AND TORONTO, ONTARIO, CANADA

EDITORIALS

Time for the Big Push—In Adequate Wiring

The electrical industry is at last awakened to the seriousness of the inadequate wiring problem. Loss of appliance sales and resulting revenues to utilities, exasperated electric customers, and increasing obsolescence of wiring in housing units and commercial and institutional buildings present a clear picture to us all.

Everyone now recognizes that the contribution, great as it is, of inadequately financed Adequate Wiring Bureaus is not enough. Add to this the scattered jobs of such companies as Consolidated Edison Co, Cincinnati Gas & Electric Co, Union Electric Co, Arizona Public Service Co, Portland General Electric Co, Central Illinois Light Co, and others, and the total job is still meager.

Even with the promotional material, advertising, and moral support of individual manufacturers, trade associations, and technical publications, the problem has scarcely been attacked.

A bold new coordinated program lasting not one year but five or ten years is the urgent need of the day. Every activity now being carried on needs acceleration, but in addition, we need an all-industry effort of sizeable proportion.

The program needed is fivefold: First, Organization of a working committee in every town and city—an electrical league, adequate wiring bureau, or equivalent. Second, Agreement on new standards for wiring adequacy with appropriate identification and aggressive steps toward securing adoption at the local level. Third, We must have a blueprint followed by a test of a complete adequate wiring program for typical towns and cities which should include the following:

1. An all-out promotional program covering the problem as it applies to the residence and apartment. Advertising with the use of television and a satisfactory movie will contribute materially.

2. A house-to-house canvass of the homes to evaluate the extent of the problem, the attitude of the public, and to provide additional material for promotional use. This would require questionnaires and adequate record keeping. A scientific sampling would be desirable.

3. Follow-up by utilities, electrical contractors, and retailers to establish the extent to which truly adequate wiring, new business, and satisfied customers can be acquired.

4. Adequate customer financing plans for the required wiring and the appliance sales that will follow

Fourth, Tests of the above program in a number of locations to prove its worth and overcome any weaknesses. This would require financing and manpower from industry associations. Fifth, A nationwide effort through all branches of the industry to promote the resultant wiring program at local and national levels.

Parts of this program have already been tested and can be accepted without further investigation. The financing of customer wiring is a simple matter as Cincinnati has proved. Consolidated Edison has proved that a magnificent film which tells the story can be produced. The Adequate Wiring Bureau and the electrical leagues have established a pattern of local cooperation. The Adequate Wiring Bureau's promotional material is excellent.

All that is needed is a strong planning group with adequate financial backing. The National Adequate Wiring Bureau is probably the first choice as the planning group. All industry associations can and should supply funds and contribute local and national leadership.

Growth Holds Key to 12-Kv Savings

Opportunity for economy is greatest when higher distribution voltages, such as 12.47 or 13.2 kv, are carefully planned for rapid growth areas. Most of the savings lie in larger substations and higher subtransmission voltage. Particularly favorable is the case where a new community springs Phoenix-like from a wilderness. There no cost is incurred to convert existing plant, and load is waiting to pay for the heavy initial expenditure of a completely new system. Under these ideal conditions, 12 kv offers savings over 4 kv of $10-20 per kva.

This information comes from a Pacific Gas & Electric Co economic comparison reported by Clive E. Baugh in this issue. Reference to it discloses bold use of 16,000/21,333/26,667-kva transformers supplied at 66 kv for 12-kv substation units. Comparative assumptions placed 10,000/12,500-kva units in the 4-kv substations.

Only venturesome engineering and a management with great faith in the growth potential of its service area could build such distribution. An element of risk is inescapable, but these savings are realized only if virgin areas are not compromised with timid introduction of lower voltage primaries. Conversion costs run high—from $30 to $100 per kva; such costs could dissipate much of the savings from subsequent changeover to the higher voltage.

Other engineers have demonstrated that 4 kv is adequate to serve all foreseeable residential loads. There is no need, they say, to rip out a sound 4-kv system. The only question is how to expand its capability economically to match load growth and area expansion. Here higher voltage demands evaluation.

Planning philosophies of many utilities specify 12.47 or 13.2 kv for distribution in new residential areas. They contemplate extending these higher voltage areas into the fringes of existing 4 kv in lieu of further additions to 4-kv system capacity. Conversion costs are completely avoided for new plant, and minimized by careful selection of 4-kv areas subsequently taken over. And existing investment in 4-kv plant is kept in service.

Engineers must weigh these angles in evaluating the trend to higher primary voltages. They must determine whether growth potential will justify the expense and confusion common to multiple standards. For economy in serving new load is the basic justification for a change in distribution voltage.

Appliance Dealers Need Showmanship

Forty years ago the vacuum cleaner was being introduced to the public. It was introduced by door-to-door salesmen who visited every wired home, threw a bag of dirt on the floor, and proved that the cleaner would not only pick up that dirt but all other dirt as well. That was showmanship.

Today the electric appliance industry needs that showmanship. It is a miracle that electric appliance stores ever sell any. Walk into the average store. The shelves are stocked with the best appliances in the world. But not one is being demonstrated. Even worse the store is not ready to demonstrate any appliances other than the radio and TV.

If appliances are to be sold they must be demonstrated. Prospective buyers must be shown how well a dishwasher washes dishes, how well an automatic washer washes clothes, how well a dryer dries them. They must see a disposer whisk away garbage. They must feel the warmth of an electric blanket. And until prospective buyers of appliances are given such demonstrations, sales of electric appliances will lag.

Facts about Cables, Wire, and Insulation

The many changes taking place in the field of power cables, wire, and insulation are clearly illustrated in a survey beginning on page 104. This is the second such study prepared by Electrical World on "Trade Marks and Trade Names for Power Cables, Wire, and Insulation." The first appeared in the Nov. 5, 1951 issue.

In compiling the results of the second survey, EW editors discovered that nearly 20% of the listings in the first survey were to be dropped. But the additions not only made up for the omissions but even required approximately an additional page of space. These numerous changes took place in the comparatively short period of 33 months. And they indicate the progress that has been made in this section of the industry.

Electrical World believes that this information is the most accurate available anywhere. It was compiled with the wholehearted assistance of the manufacturers involved. Now it is being offered to the industry as a useful tool. Reprints will be available at moderate prices.

Drop Frequency to Warn of Air Raids

Devices to sound an advance warning in the home in the event of enemy attack are being studied by the Civil Defense Administration. According to Administrator Val Peterson, one experimental device is designed to give an alarm when the system frequency is lowered.

This proposal appears to have merit. It would provide a means of quickly and positively warning everyone at home in the expected target area. The device could be made virtually foolproof so that home owners could not tinker with it. Furthermore, a message on the device could tell the householder, to tune the radio to the Conelrad frequencies—640 or 1240 kc.

But operation of the alarm should be based on a predetermined sub-standard frequency maintained for a definite length of time. Otherwise, the device might cause a great deal of consternation and confusion among householders should the local utility experience a momentary drop in frequency to within the critical operating zone.

Get Out the Vote on Nov. 2

Another election day is approaching. Although it will not be a presidential election, it will be important. All memberships in the House and over a third of the Senate memberships must be filled. Two years ago the electric companies contributed greatly to the drive to get the American voter to exercise his privilege as a citizen. Today is the best time for the companies to start a repeat performance.

THE ELECTRICAL WEEK

The Issue's News Highlights . . . Showdown vote on proposed AEC power supply contract with private utilities neared as EW went to press.

Interior directs BPA to make changes asked in survey . . . Clarence Davis to replace Tudor.

Eisenhower's directive to AEC to transfer some of its power load from TVA to private enterprise was upheld last week by the Senate, 55-36.
Republicans voted en bloc to defeat an amendment to the atomic energy bill that would have limited AEC to contracting for power for its own needs only . . . Meantime, in Little Rock, Ark., Mississippi Valley Generating Co was chartered at the private firm that would build the 600,000-kw plant to supply AEC via TVA. (Earlier story Page 74).

Light's Diamond Jubilee Television Show on Oct. 24 will be broadcast over the largest network—310 interconnected stations—ever assembled for a single TV program. All available stations of the ABC, CBS, DuMont and NBC networks will be used for the two-hour show, which will extoll the achievements of the private electric companies over the last 75 years. David O. Selznick, making his television debut, will produce the show.

Pennsylvania PUC approved consolidation of 14 power companies in Crawford County under common ownership. The companies, controlled by Harley D. Carpenter, Meadville, will continue serving 4,477 consumers under present rates as Carpenter Light & Power Co.

Stanford Research Institute was named by AEC as one of three national Industrial Information Depositories of unclassified information concerning developments in the field of atomic energy. Other depositories are being set up at Atomic Industrial Forum in New York and John Crerar Library in Chicago.

Commonwealth Services, Inc, began publication of a monthly letter entitled, "Public Utilities—Perspective." First issue discusses sales and earnings performance of electric utilities in the last year. For free copy, write D. M. Mackie, Commonwealth Services, Inc, 20 Pine St., New York 5, N. Y.

North Dakota PSC dismissed complaints by two co-ops, Nodak Rural Electric Cooperative, Inc, and Williams Electric Cooperative, Inc., that Northern States Power Co and Montana-Dakota Utilities Co, respectively were infringing on their territories.

Power site battle was pressaged as Washington State Power Commission decided to apply to FPC for a permit to build Priest Rapids Dam. Grant Count (Wash.) PUD already has asked for a permit, other PUDs would like to get in on construction of the Columbia River Dam.

Off the Washington Wire . . . House was scheduled to begin consideration of the omnibus rivers, harbors and flood control bill last week containing authorization for several water power projects. Among those selected are: Canyon Dam Project in Texas, power plants at the Greers Ferry and Beaver Reservoir in Arkansas.

House Interior and Insular Affairs Committee has approved a bill which would provide for the sale of certain Parker-Davis Project transmission facilities to public agencies in the states of Arizona and California.

John H. Spraggon, manager of Westinghouse's Steam Division, is taking a turn as director of the Power Equipment Division of the Business and Defense Services Administration—a Commerce Department agency.

Export-Import Bank of Washington has agreed to participate to the extent of $1.2 million with Westinghouse Electric International Co in financing sale of a 50,000-kw thermal plant to an established Spanish concern.

Charles Dyson and associates announced purchase of outstanding stock of Hubbard & Co., Pittsburgh, Pa., makers of pole line hardware and other utility supplies.

All electric service was cut off July 17 at the 20-unit cooperative Security Apartments in Louisville, Ky., by order of the city. Reason for the service cuts was inadequate wiring. Tenants, their circuits overloaded, had been unable to agree on rewiring.

Dumont, N. J., a community of 15,000 in the New York metropolitan area, approved a building code addition requiring 100 amp minimum service entrance conductors for all new or existing homes where an electric service is being installed. Provision will become law subject of course to a general public hearing.

Executive Changes . . . Ebasco Services, Inc, promoted Frederick C. Gardner from executive vice president to president and chief executive officer, succeeding T. C. Wescott, who has been appointed vice chairman . . . Florida Power & Light Co has named Malcolm B. McDonald a vice president. He will continue his advertising and public relations duties. W. F. Blaylock, former assistant to the president, takes over McDonald's position as secretary.

Voltage unbalance of a 3-phase transformer bank is primarily a function of a single-phase load on the bank and is relatively independent of the ratio of single-phase load to 3-phase load.

AEC Power Supply Pact Stirs Debate

Commission's proposed contract with private utilities to supply energy to TVA area causes prolonged and bitter argument on Senate floor delaying action on revision of atomic energy law

Senate fight to head off an Atomic Energy Commission power supply contract with private utilities moved toward an initial showdown last week as the Senate prepared to vote the contract up or down.

Agreement to take the vote came as the Senate debate on atomic energy legislation went into its seventh day. However, opponents of the power contract threatened to prolong debate further if they failed to shunt aside the sower supply contract on the first vote.

Tennessee Valley Authority backers, who see the contract as an attempt to clip TVA's wings, led the effort to kill negotiation of the agreement under which a group made up of Middle South Utilities, Inc, and Southern Co would furnish 600,000 kw of power to AEC in TVA area.

Cooper Opposes Contract

Opponents of the contract picked up important support from Kentucky Sen John Sherman Cooper, the only Republican senator from the TVA area. In a speech on the Senate floor, Cooper promised to back an amendment which would rule out the AEC-private utilities contract.

The Kentucky Republican opposed the contract on the grounds that AEC has no authority to purchase power for use in the TVA system. He argued that AEC would be usurping TVA authority if the contract is consummated.

Under terms of the proposed contract AEC would purchase some 600-000 kw of power from a plant to be constructed at West Memphis, Ark., by the Middle-South and Southern companies. This power would be piped into the TVA system at Memphis displacing power which TVA would deliver to AEC at Paducah, Ky., 160 miles upstream from Memphis.

Cooper said President Eisenhower has been "motivated by the sincerest purpose" in his efforts to meet a power deficiency at Memphis by means of the proposed contract. However, Cooper said he could not support such a device for meeting TVA loads.

Instead Cooper suggested that the new TVA chairman, when he is appointed, be given the task of studying alternative methods of meeting TVA loads. One alternative, Cooper said, would be to permit the agency to finance its generation expansion through issuance of revenue bonds. He noted that TVA's effort to obtain funds from Congress for the proposed Fulton Plant near Memphis had been thwarted under both Democratic and Republican administrations.

Although Cooper had conferred with President Eisenhower prior to delivering the Senate speech, the Kentucky Senator gave no indication that he had White House support for his proposals. With sufficient Republican support in the Senate, they were seen as one possible way of heading off debate on the atomic energy measure.

Although most of the first week's debate on the atomic energy bill had centered on AEC's authority to make power supply contracts, this particular section of the bill is the same as in the existing law. The power fight was no more than a side issue in the argument over the bill which would bring far-reaching changes in the nation's atomic energy program.

Amendments Offered

Among other things, the bill would permit private industry to develop, construct, and operate atomic power plants under government license. It would also permit research in all industrial and medical phases of the nuclear field.

As debate on the bill went into its second week, at least three amendments were pending on the power features of the bill. They sought to:

- Clarify AEC's authority to negotiate the power supply contract with the Middle-South-Southern group.
- Forbid AEC from entering in such a contract.
- Extended the preference clause to sale of power from all nuclear power plants licensed under the bill.

This last amendment was offered by Democratic Sen Guy Gillette of Iowa and seven other senators. It would require that public bodies and rural electric cooperatives be given priority in the purchase of power from any AEC licensed power plant whether built by public or private utilities.

Fulbright Backs Private Plan

Democratic Sen William Fulbright carried the brunt of the debate in behalf of the proposed Middle South-Southern contract. If consummated, the steam generating plant to be built by the group would be in Fulbright's home state of Arkansas.

In the course of his presentation Fulbright argued that the cost to the government for power from the private plant would be only slightly more than from TVA. AEC figures put into the record by Fulbright indicated that the privately financed Electric Energy Inc up until the first of this year had supplied power to AEC's Paducah Plant cheaper than TVA (Table I).

The Arkansas Senator also presented figures to show that TVA stands to make a sizable return on its power sales to AEC, a sister government agency. Annual TVA return above cost on 600,000 kw of power to AEC would be around $4,718,000, the figures showed. If TVA makes an equal return on its other sales to AEC by 1956 the TVA return from the sales will be around $23,069,100 anually (Table II).

Fulbright argued that TVA will overcharge AEC in order to keep down its rates to valley customers. It was noted that TVA average revenue from power sales to Memphis is 3.88 mills per kwhr while the average rate to other federal agencies is 4.52 mills.

Here Are Figures Used by Fulbright

Table I—Average Cost of Power Sold to AEC for Paducah Plant

	Kwhr Delivered (Millions)	Average Cost (Mills per kwhr)
Jan. 1, 1951—Dec. 1, 1953		
TVA		
Normal	2,653	6.37
Supplemental	334	10.08
Weighted average		6.79
Electric Energy, Inc.		
Permanent	1,289	3.22
Interim	1,513	7.83
Weighted average		5.71
July 1—Dec. 31, 1953		
TVA		
Normal	1,709	5.06
Supplemental	283	10.65
Weighted average		5.85
Electric Energy, Inc.		
Permanent	1,247	3.16
Interim	815	7.75
Weighted average		4.98
Jan. 1—March 31, 1954		
TVA		
Normal	1,053	3.72
Supplemental	394	7.90
Weighted average		4.86
Electric Energy, Inc.		
Permanent	683	3.26
Interim	475	7.70
Weighted average		5.08

(Source: AEC)

Note: Power supplied to Paducah plant prior to summer of 1953 came from TVA system and systems of Electric Energy, Inc., member companies. In summer of 1953, TVA's Shawnee plant and EEI's Joppa plant went on line and began to serve Paducah plant.

Table II—TVA's Contract with AEC for Power Delivered after July 1956

	Total	Mills Per Kwhr
TVA annual cost of supplying 600,000 kw of power to AEC at Paducah	$13,318,000	2.56
TVA revenue under contract with AEC	$18,036,000	3.47
Difference	$ 4,718,000	.91

(Source for above figures: AEC)

TVA revenue in excess of costs equals.....$7.86 per kw yr

Total TVA commitments to AEC

Paducah	1,205,000 kw
Oak Ridge	1,750,000 kw
	2,935,000 kw

If same return in excess of costs applies for all TVA commitments to AEC, total profit per year in 1956 would be 2,935,000 kw times $7.86 equaling $23,069,100. This compares with TVA's total net power income in 1953 of $18,626,714

Comparison of TVA Rates

	Mills per kwhr
Average realized from sales to federal agencies	4.52
Average realized from sales to other customers	3.88

BPA Shake-Up

Aandahl directs NW agency to put into effect recommendations of survey team

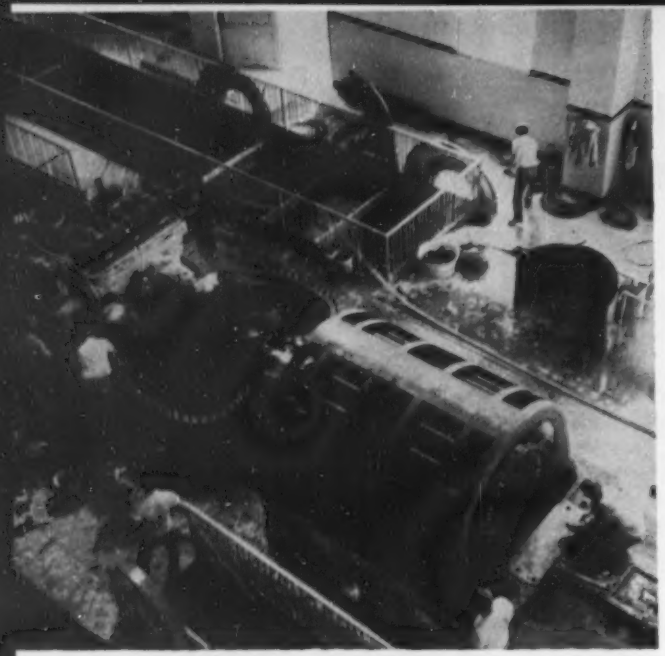
The long-expected shake-up in the organization of the Bonneville Power Administration was spelled out last week with the release of the recommendations of a special survey team and a directive from Assistant Secretary of Interior Fred G. Aandahl to BPA Administrator William A. Pearl to put the recommendations into effect.

Biggest changes in the cards are these:

- Downgrading of the engineering division, with a cut in personnel of about 40%. Upgrading of maintenance and operation.
- Abolishment of the present executive committee, with complete responsibility for management vested in the administrator.
- Personnel reduction from present total of 2,703 down to 2,100. Engineering would drop from 1,006 to 600, administrative management division from 482 to 400, operation and maintenance division from 1,154 to 1,050, and top management division from 482 to 400.
- Change of the six-man Washington liaison staff, now operated as a district office of BPA reporting to the administrator in Portland, into a liaison staff reporting to Assistant Secretary Aandahl not only for BPA, but also for the Southeastern and Southwestern Power Administrations—with no increase in personnel.

Reports Due Sept. 1 . . . Details of just how and when the reorganization plan will begin to be put into effect were expected to be announced from Portland headquarters by BPA Chief Pearl. Undoubtedly some steps will be taken without delay, since Aandahl has specified that progress reports are to be submitted to his office Sept. 1.

By and large the recommenadtions of the survey team will be put into effect as spelled out in the 54 pages of text and tables with which the team backed up its recommendations. Pearl is given authority to make minor devisations from the recommendations, but any major changes from the organizations laid down will have to be okayed by both Aandahl and the undersecretary.



Generator Dismantled

Debris Removed

Cleaning Up Mess Left by Rampaging Rivers

Central Power & Light Co, Corpus Christi, Tex., has begun the job of cleaning up the mess left at three of its plants in the wake of record floods on the Rio Grande and Devil's Rivers (EW, July 12, p 88).

Top photo shows workmen dismantling the turbogenerator in the Devil's River steam plant preparatory to cleaning and drying.

In photo at bottom left, workmen in the same plant are removing debris from lower level.

Third photo shows work beginning on Lake Walk hydro plant. Raging waters knocked a hole in the roof, smashed the railing, and washed out windows and doors of this plant.

Specialists from other locations are assisting local crews with the rehabilitation work.

The flood reached a level of 9 ft in the turbine room of the steam plant and completely inundated the Devil's Lake and Lake Walk hydroplants. Eagle Pass hydro plant, on the bank of the Rio Grande but fed by an irrigation canal, was not flooded but was put out of service because of flood breaks in the canal.

No prolonged service interruptions resulted from flooding of the plants. Loads were picked up by other plants in the utility's system.

Structure Repaired

Stevenson Charges Denied

Hoover declares he never said the government should get out of business of generating and distributing power

Ex-President Herbert Hoover has charged Adlai Stevenson with "three grave misstatements of fact" in an Oregon address in which the Democratic party leader included the former Republican president in line of fire while attacking the Eisenhower Administration's natural resources policies.

But Hoover said it appeared Stevenson "was led into" the errors after briefing by Oregon critics of GOP power partnership programs. Specifically, Hoover denied he vetoed the nation's first multipurpose hydro development project and that he ever had said the "federal government ought to get out of the business of generating and distributing power as soon as possible."

Stevenson's Statements . . . Main statements made by Stevenson in his Eugene speech July 10 were as follows:

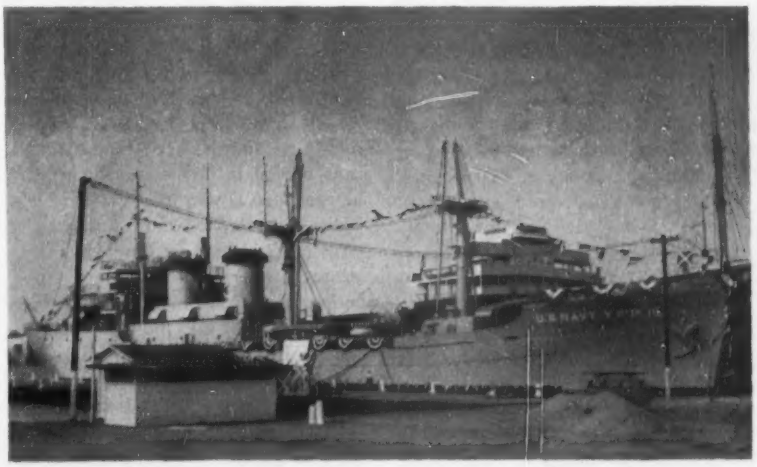
- Republican Administration has made "a drastic change in what has been virtually a bipartisan natural resources program for almost half a century."
- Administration is abandoning multipurpose idea of hydroelectric power development. Of 23 new starts by Army Corps of Engineers "not one includes power or truly multipurpose."
- Secretary of State John Foster Dulles and Interior Secretary Douglas McKay "abandoned negotiations for Libby Dam. . . . I wonder if the present discussion of Libby Dam is a smokescreen to obscure the demise of the high dam at Hells Canyon. What assurance is there that the Libby negotiations with Canada will not be dropped again next year after Hells Canyon is lost beyond redemption?"
- President's order to Atomic Energy Commission to contract with private utilities to supply power in Tennessee Valley Authority area will result in higher costs for the power even allowing for taxes utilities will pay.

The reference to the veto involved Stevenson's claim that "few remembered that in 1931, when America was trying so hard to get back to work, President Hoover vetoed the first large scale attempt to develop this nation's hydroelectric power." He noted Hoover's appointment to a commission to study resources development and made the comment after stating Republican thinking on this subject hadn't changed.

Hoover Denies Charges . . . Ex-President Hoover, vacationing in Oregon at the time of the Stevenson speech, lost no time in denying the charges. He declared: "I never said that government should get out of the electric power business. What I did say was that the federal government must continue to construct multipurpose hydroelectric dams, but that the federal government should get out of the socialistic and bureaucratic empire building by way of operating the powerhouses and distributing power; that the federal government should sell its power at the bus bar to the municipalities, the states and the private utilities; that is, should sell it at rates which would return interest and amortization to the federal government on its investment in power and pay state and local taxes which are now mostly tax exempt."

[In a speech April 11, 1953, at Case Institute of Technology (EW, April 20, 1953, p 104), Hoover made several proposals to end "creeping socialism" in the power field. These were: Congress should cease appropriating money for construction of steam or hydro plants built solely for power; Congress should not appropriate money for multipurpose projects unless power is first leased for distribution to electric companies and state or local bodies set up by states; a commission should be set up to study federal role in power field. Then, near the end of his speech, Hoover said: "The objective of the whole proceedings should be to get the federal government out of the business of generating and distributing power as soon as possible."]

Favors Multipurpose Dams . . . The elder Republican statesman, in his an-



Most Power Afloat: Navy's YFP 10

Moored for trial operation in Jacksonville, Fla., the world's largest floating powerhouse, the Navy's YFP 10, stands ready to be towed to any spot where emergency power may be needed. (In the picture, white superstructure of a merchant ship can be seen behind the gray power ship.) The 6,000-ton vessel, converted from the dry cargo ship Coastal Racer, can develop 34,500 kw from its oil-fired steam turbine generating plant. The YFP-10 can go from a "cold ship" to full power output in four hours and operate at normal load for 30 days without refueling. Propulsion machinery was removed to make room for the power plant. The ship will be towed to her duty station.

swer to Stevenson on July 12, also declared: "I have advocated multiple purpose dams when justified for the past 50 years. Further, I had a large part in bringing about, and almost completed during my Administration, the construction of the first and largest multiple purpose dam in the country. That was the Hoover Dam in Colorado. During my Administration, we prepared the plans and I recommended the construction of the Grand Coulee. It was later built as planned."

Hoover admitted he had vetoed the Norris Dam bill: "I vetoed it because the bill contained none of the adequate protections of the federal treasury which had been included in the Hoover Dam legislation of four or five years previously, and because the bill would establish pure socialism through the federal manufacture of fertilizers."

The ex-President said he favors dams built by local authorities formed by states but did not elaborate. He declined comment on specific project proposals for the Pacific Northwest, but said he preferred delays in dam building in view of the federal budget deficit and the make work value of such construction during periods of high unemployment.

The former Republican President was asked why the water resources task force which held hearings in Portland in June was as interested in government philosophy as in efficiency. Hoover said "this commission has much greater scope than the original commission. It is empowered to go into matters of policy as well as those of government structure."

McKay Replies . . . Interior Secretary Douglas McKay also took issue with statements made by Stevenson. "Local Democrats" were a little careless with the facts they supplied the Democratic leader, McKay asserted. He ridiculed charges that Republicans are using proposed Libby Dam on the Kootenai River in Montana as a "substitute" for a high Hells Canyon Dam on the Snake River. Libby would be important because of the store it would impound, thus firming up power generation of down river dams on the Columbia, he pointed out.

McKay also rapped Stevenson's charges department policies threaten the preference clause. "The preference clause is a matter of law. We did not make the law and we aren't changing it," he said.

CLARENCE DAVIS, Interior Department solicitor, takes over as undersecretary on Sept. 1

Davis to Succeed Tudor

Interior Department is to get a new undersecretary Sept. 1 when solicitor Clarence A. Davis moves up to replace Ralph A. Tudor.

Davis, whose nomination was approved last week by the Senate Interior Committee, has been department solicitor since the Republicans moved in last year. Before that he practiced law in Beaver City, Neb., where he was active in water rights litigation. He is a former Nebraska attorney general and a former general counsel for Consumers Public Power district, which is a political subdivision of the state engaged in production and distribution of electric power.

As principal legal adviser to Interior Secretary Douglas McKay for the past year, Davis has played a key role in formulating department power policy and has been a frequent speaker on power policy matters.

Returns to Private Firm . . . Tudor, a former district engineer in the Army Corps of Engineers, returns to his own firm in San Francisco after serving more than a year as Interior undersecretary. Tudor came to Interior May 15 last year with the hope of spending no more than a year on the job. He agreed to stay on until after the Congressional adjournment at the request of Secretary McKay.

During his short tour of duty, Tudor has coordinated various policy studies and is one of the chief architects of Republican power policy for Interior. He has also directed reorganization of such agencies as Bureau of Reclamation and Southwestern Power Administration.

RALPH A. TUDOR

'Why' of Accidents Important . . .

. . . C. J. Rutland tells EEI Accident Prevention Committee, stating cause of mishaps needs more investigation

Pattern and types of accidents within the utility industry are the same now as ten years ago. The number occurring annually has been reduced, but little thought has been given to the "why" of an accident. These observations were made by C. J. Rutland, Texas Power & Light Co, at the 56th meeting of the Accident Prevention Committee of Edison Electric Institute in San Francisco, July 1-3. Practices and problems relating to grounding of lines were discussed at length also.

Men, working conditions, training programs and inspection routines within the industry are all good, but still accidents take place, said Rutland. He said that more importance should be placed on why an accident happens, rather than on how it happens.

Emotional Factors . . . Amplifying this view, A. H. Doud, Rochester Gas & Electric Co, said some means should be found to impress upon the crew foreman the importance of emotional factors that tend to distract the lineman from his work. He thought that such factors as birthdays, sickness or troubles within the employee's family should be considered by the crew foreman.

H. B. McMahan, Florida Power Corp, stated the foreman is the utility's key "safety engineer." Greater reliance must be placed on him because the safety director cannot contact and spend enough time with each crew.

To help in the preparation of EEI's safety news letter to foremen, McMahan asked that the details of each accident, including emotional factors but excluding the names of persons, company or city involved, be sent to him.

AIEE Paper Cited . . . The current American Institute of Electrical Engineers' Transaction paper, "Placement of Protective Grounds for Lineman Safety," was cited as important reading by C. F. Dalziel, University of California, Berkeley. This paper by E. J. Harrington and T. M. Martin, Bonneville Power Administration, presents these conclusions: Short-circuiting and grounding of all conductors at the work location will provide sufficient protection for linemen, whereas the present practice of working between grounds with no ground at the work location does not provide adequate protection; ground fault currents at work locations may constitute a hazard to groundmen; while additional grounds adjacent to the work location may decrease the earth potential, the reduction will not be enough to eliminate the hazard.

Of the 55 fatalities in 1952, said E. E. Beck, Idaho Power Co, 52 were phase-to-ground situations. Why not, he questioned, cover all phase and ground conductors, except for actual work area, when working on wye systems? He pointed out that all phases on delta systems are covered. But discussion brought out that no rubber goods are available for covering ground conductors, even though this practice is recommended in safe working practices.

Vehicle Accidents . . . Cognizance was taken of the growing need to consider utility vehicle accidents when the committee voted to study vehicle accidents and driver training programs jointly with the transportation committee of EEI. It was suggested that some measure of vehicle accident frequency, similar to the personal injury severity rate, be set up to measure the current situation.

Luncheon speaker O. R. Doerr, Pacific Gas & Electric Co, said we will need a new type of man in our society as science gives us new tools and new ways of converting energy. He suggested the science of automation as one of these important tools that should be followed by all segments of the utility industry.

Claude Haggard, California Oregon Power Co, commented on the yielding of rescuers to mechanical equipment that arrives while artificial resuscitation is being applied. His company directs crews to rely upon the manual method and to use the mechanical equipment merely as an inhalator.

R. E. McCann of the Southern California Edison Co, felt that current developments in rubber compounds and plastics should result in practical, durable, and not-too cumbersome climbers.

Seattle and B.C. Agree on Flood Rights

City Light of Seattle will be able to impound an additional 200,000 acre-ft of water behind Ross Dam on the Skagit River, as the result of an interim agreement it has reached with British Columbia.

The agreement provides that City Light will pay $5,000 for flood rights for the 1954 storage season. It is necessary because the dam backs the river back up into British Columbia.

Permanent settlement of flood rights on the Skagit is expected to await settlement on the proposed Libby Dam in Montana, which would back the Kootenai River into British Columbia about 42 miles. The United States government recently asked the International Joint Commission to take up again the Libby Dam negotiations which broke down a year ago when the Canadians reportedly were asking a large share of the power that would be produced by the dam.

City Light's temporary agreement, approved by the City Council utilities committee, will make it possible to raise the level of Ross Lake about 18 ft, to be drawn down next winter when power demands are heaviest.

More News on Page 158

CONTAMINATION of insulators by chemicals in the air caused frequent flashover

FOG-TYPE SUSPENSION INSULATORS, which provide ample creepage length, are installed as one measure for reducing flashovers when an insulator surface becomes contaminated

4 Measures Minimize an Unusual

H. R. HARRIS, Electrical Engineer of Power Plants, Detroit Edison Co, Detroit, Mich.

Unusual and severe contamination of insulators on the 120-kv switching equipment at its Trenton Channel Station prompted Detroit Edison Co to initiate an extensive program of study and experiment. The program evolved four measures for combating atmospheric contamination of insulators, such as is shown in Photo 1. These measures are:

1. Provision of ample insulator surface leakage length, as shown in Photo 2.

2. Periodic silicone coating of insulator surfaces, as in Photo 3.

3. Periodic washing, as in Photo 4.

4. Reduction of contaminants in the atmosphere through cooperation with a neighboring plant.

At least one of these, the application of silicone coating, is believed to be new to the industry.

Flashover a Problem . . . Atmospheric contaminants from a nearby chemical plant settling on the 120-kv bus insulators were the cause of flashovers. With the cooperation of the neighboring plant, the contamination was reduced through the installation of precipitators and filters. Incidentally, this installation resulted in the saving of chemicals.

During the studies at Trenton Channel, insulator leakage length was increased by employing the newer type of fog and smog suspension insulators. The number of pin-type insulators for disconnects was also increased from 3 to 4 per pole, an increase in total leakage distance from 99 to 132 in.

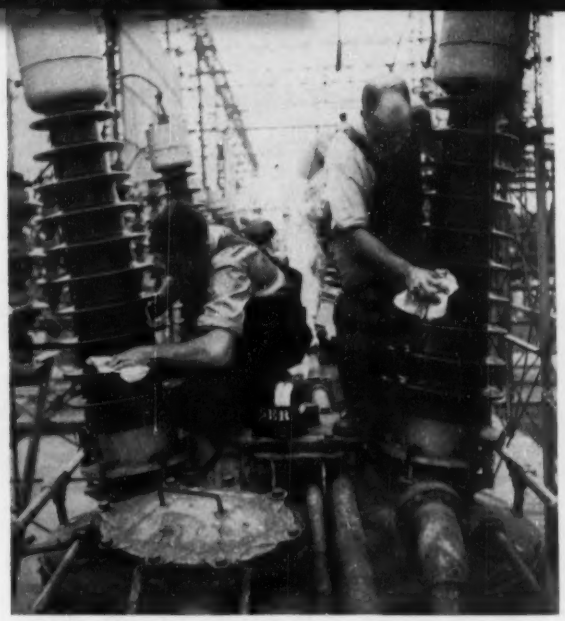
Increasing leakage distance on suspension insulators and pin-type disconnect insulators eliminated flashover of these over a period of two years. Many of these fog and smog-type suspension insulators have not been cleaned, except by rain, since installation even in places where considerable contamination covers their surfaces.

Fog-type insulators, like those in Photo 2, have been in use more than two years in highly contaminated locations, such as towers next to the chemical plant. They have not flashed over. In a limited number of instances, the leakage distance of bushings has been lengthened by cementing additional porcelain to the top of the bushings.

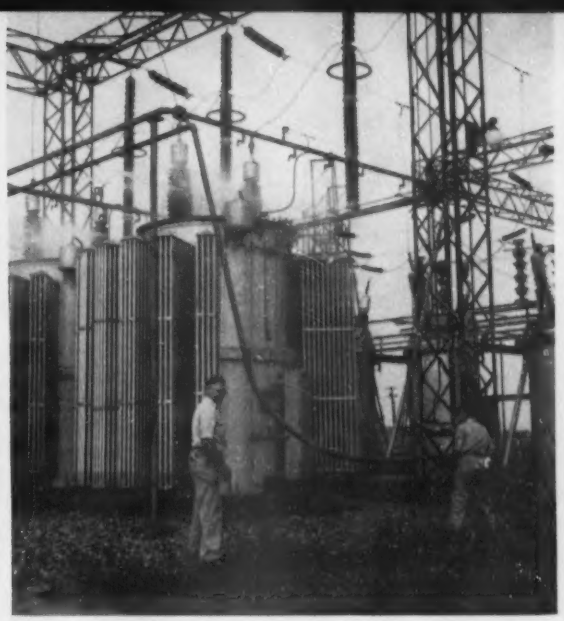
Silicone Coating . . . The table for surface resistivity of materials in the standard Hand Book for Electrical Engineers led to the search for a wax for application to the insulator surface that would raise the surface's resistance far above that of clean wet porcelain. The wax needed was one that would not carbonize as a result of leakage current nor deteriorate too rapidly when exposed to corona.

As silicone has been used for protection against insulator surface contamination, several kinds of silicone fluids were tested with encouraging results; and immediate application of various silicones was made. Test data obtained are shown in Fig 1. These silicone fluids proved valuable in the field for preventing flashover.

Various percentages of vehicle were mixed with the silicone oil and tested for the amount of leakage current and the number of cycles of contamination. These tests showed that a mixture of 50% each of vehicle and silicone oil endured the greatest number of cycles of contamination before the leakage current became excessive. In applying this mixture to insulators in the field, however, a considerable amount of contaminant collected on the surface before the coating dried. Accordingly, Detroit Edison engineers undertook to develop a new silicone fluid that



SILICONE COATING, applied to insulator surfaces with a rag, proved effective in reducing flashovers that were caused by contamination



WASHING INSULATORS is performed with a spray system supplied by a gasoline-engine-driven water pump connected to city water supply

Case of Insulator Contamination

would dry in a few minutes and have a harder surface.

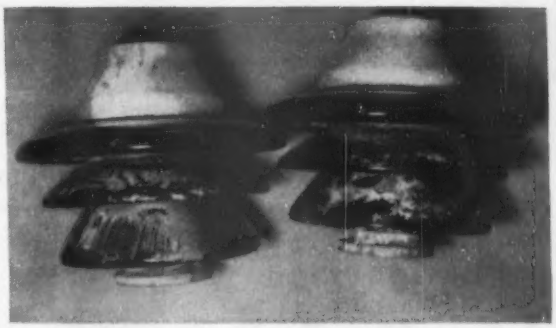
Laboratory tests proved that the developed coating lowered the insulator leakage current and withstood even more cycles of contamination. As used here, cycles of contamination mean the number of times the energized insulator under test is subjected to contamination in the 100% humidity test cabinet and then washed off with water spray.

Field Experience . . . This new silicone, applied to a number of insulators in the field for about five months, appears to be satisfactory, and a newer silicone, which laboratory tests show has a longer life, is now also under field test.

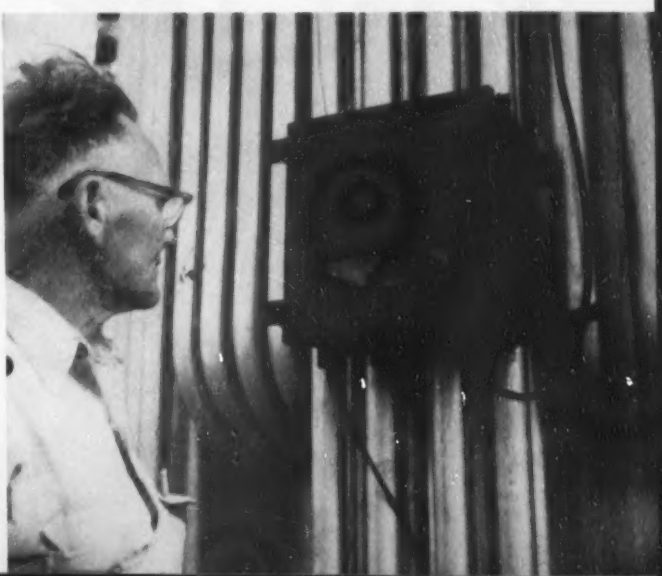
Durability of the silicone coating is limited by several factors. To the present, it appears that an application under conditions encountered in the field is good for at least three months. It is essential that the insulator be clean. Such solvents as carbon tetrachloride, isopropyl alcohol, or water can be used. Alcohol does an efficient job, is safest to apply, and is also the vehicle for mixing with the silicone.

Silicone may be sprayed on the insulator. But Detroit Edison's experience proves that it may be applied easily and effectively with a cloth. Two coats insure complete coverage of the insulator surface. Laboratory and field tests are still under way to determine whether several coats will last longer than a single application.

The silicone coating has been used at the Trenton Channel power plant since April 1951. Thus far only two out of several hundred insulators with silicone coatings have flashed over. A mixture of 5 to 10% silicone with isopropyl alcohol is used except for a few positions where a higher percentage of silicone fluid is applied to determine whether the life of such a coating will be extended. It appears from

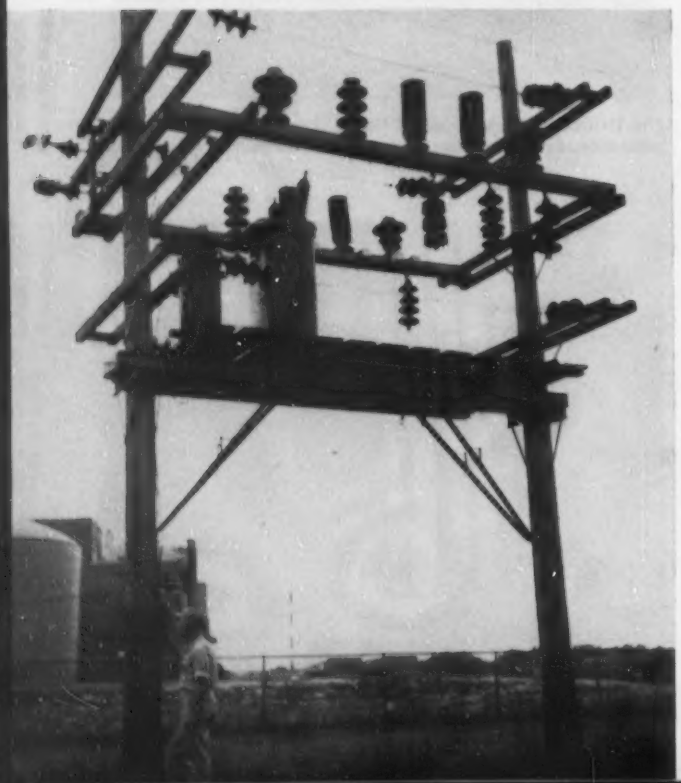


PIN INSULATORS shown above flashed over after chemical contamination. Below, recorder registers the milliamp leakage current



GLASS FIELD PLATE (above) aids patrol operators in gauging the degree of contamination on insulators at various locations in field

TEST STAND for insulators has been constructed in the more highly contaminated section of the Trenton Channel switching station



limited field tests that a 50% mixture of this improved silicone fluid is the optimum mixture, having a life considerably longer than three months at this particular location.

The cost of applying silicone twice a year to the insulators of the Trenton Channel Station, approximately 360 132-kv bushings, is about ⅛ the investment charge cost of replacing these 132-kv bushings. Laboratory and field tests show that the 161-kv class bushings, operating at 130-kv, will not prevent flashover under extreme conditions of contamination and high humidity, but that the silicone coated 132-kv bushings will not flash over when exposed to the same degree of contamination. This saving in insulation cost, however, does not apply to suspension and pin insulators, on which the cost of increasing the outside creepage distance to approximately 2 in. per kv is less than the cost of periodical silicone coating.

Increased Leakage Length . . . A few of the fog and smog-type insulators have had a coating of silicone wax. All suspension insulators in the contaminated area, including those on transmission line towers for a distance of three towers from the switching station, have had this coating.

Increasing from three to four the number of pin insulators of the disconnects in the highly contaminated sections has eliminated flashover of these units to date. This type of insulator, shown in Photo 5, has a leakage distance of approximately 33 in. It has not been found necessary to silicone coat these insulators where four per pole are used. They are washed about every 60 days unless rainfall is sufficient. Where only three pin insulators per pole are used for disconnect support, the silicone wax coating has been applied to the insulators' surfaces about every three months.

The most severe cases of insulator flashover occurred during foggy conditions when a moisture bank moved in from Lake Erie and carried contaminants from the nearby chemical plant to the already contaminated insulators. But silicone coating and washing of insulator surfaces has reduced flashover practically to nil. Without the silicone coating on the insulator's surface, water washing and cleaning by hand failed to prevent occasional flashover except where insulator creepage lengths had been increased. At first water washing was done by hand, using insulator cleaning materials.

Washing Insulators . . . The expense of changing to fog- and smog-type insulators has been justified by savings in labor, especially where suspension insulators are at high elevations. Later, Detroit Edison used high pressure jet washing at portable pump discharge pressure of 250 psi or greater.

The portable washing equipment chiefly consists of the following:

1. A water pump 25 gpm at 340 psi driven by a gasoline engine.

2. A water spray gun and connecting high pressure hose.

The pump is connected to the city water supply with a pressure of approximately 40 psi at the switching station.

Washing is performed when the equipment is de-energized. Tests showed that during washing leakage currents over the insulator were greater than 50 ma, which has been established as on the border line of near flashover. Permanent nozzles have been installed in some of the more contaminated insulator locations. Use of this equipment

minimizes labor and time of equipment shutdown and facilitates more frequent washing.

While washing reduces flashover, it is no guarantee against it, so that other means had to be considered. This resulted in the experiments with silicone wax coating. Even with this wax coating, washing was continued, but the intervals between washings were extended to two to three months. Such washings prolong the usefulness of the silicone coating.

Cleaning Time . . . Recorders like that in Photo 6 register the milliamp leakage current of insulators in a few of the most contaminated locations. These register the number of 10-, 50- and 100-ma surges of leakage current over an insulator. The operator periodically notes the recordings and makes arrangements for the equipment to be shut down and cleaned when 50-ma discharges are frequent. When the recorder shows a few 100-ma discharges, washing is performed without delay. Connections and circuits of the recorder are illustrated in Fig 2.

Field experience with this surge counter was not too satisfactory. It did not always register in dry weather even when a severe condition of contamination had developed on insulators. They have proved successful in the laboratory, however, where the humidity can be controlled.

By observing the surfaces of insulators, along with the glass field plates at various places (see Photo 7), patrol operators can determine the degree of contamination. When insulator surface contamination is observed at night in highly humid weather, the blue-colored discharge indicates some degree of contamination. Critical or near-flashover condition is signified by an orange-colored discharge.

The quantity of discharge noise is also indicative of the degree of contamination.

Test Stand . . . A test stand has been set up at the higher contaminated section of the Trenton Channel plant switching station. As shown in Photo 8, there are several kinds of insulators on this test stand, some energized. A surge recorder has been connected to various energized insulators for comparing the different kinds of insulators and the degree of contamination. The test stand permits an insulator with a surge counter connected to it to be de-energized and sprayed with a fine mist of water to determine the amount of contamination on it. It was intended that this procedure would indicate the time for cleaning insulators of the 120-kv buses. The test insulators are at about the same height as the 120-kv insulators and in line with the chemical plant producing most of the contaminant.

The chemical plant, which manufactures about 14 chemicals, including phosphoric acid and sodium phosphate, initiated the fourth measure for combating insulator contamination. The contaminant was created by the loss of chemicals through the plant's ventilators and windows. Detroit Edison's tests indicated that the major contaminant, the one causing the company most trouble, was sodium phosphate, along with slight deposits of fly ash on the insulators.

In the early stages of meeting the problem, the chemical company officials were consulted. Several hundred thousand dollars have since been spent for electrostatic precipitators and bag filters to prevent the loss of chemicals causing insulator contamination.

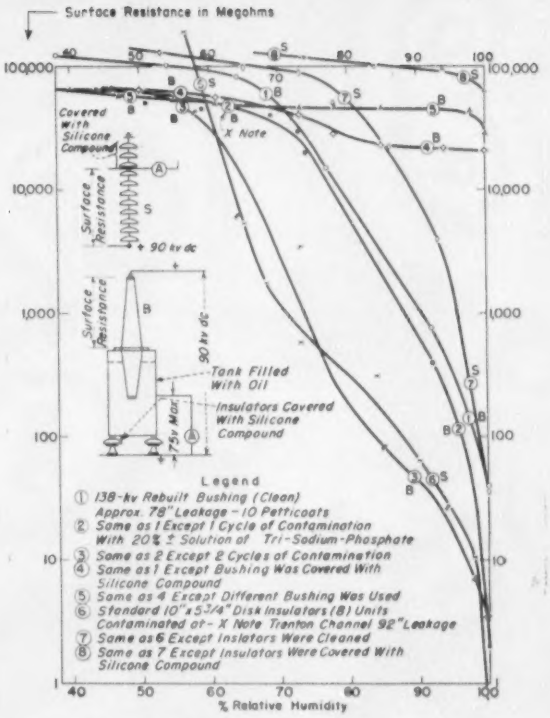
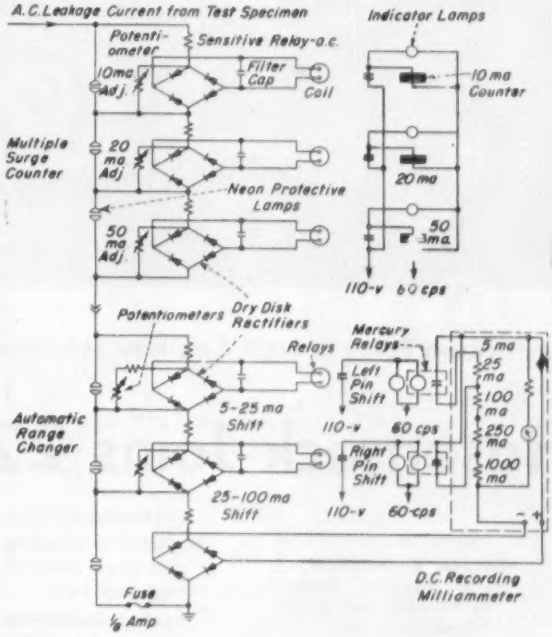
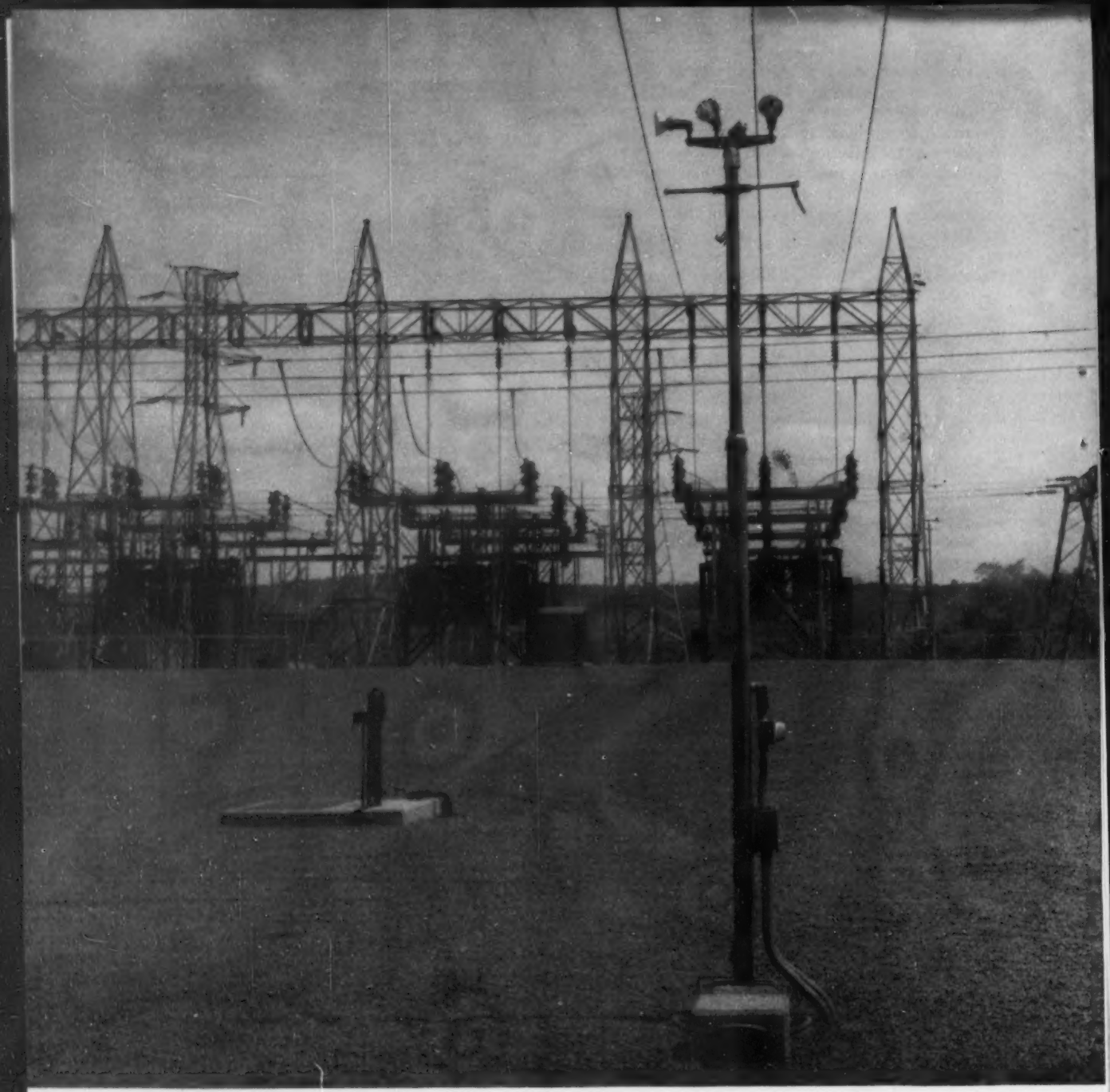

Surface Resistance in Megohms
100,000
10,000
1,000
100
10
Covered With Silicone Compound
X Note
Surface Resistance
90 kv dc
Tank Filled With Oil
Insulators Covered With Silicone Compound
75 y Max.
Legend
① 138-kv Rebuilt Bushing (Clean) Approx. 78" Leakage – 10 Petticoats
② Same as 1 Except 1 Cycle of Contamination With 20% ± Solution of Tri-Sodium-Phosphate
③ Same as 2 Except 2 Cycles of Contamination
④ Same as 1 Except Bushing Was Covered With Silicone Compound
⑤ Same as 4 Except Different Bushing Was Used
⑥ Standard 10" x 5 3/4" Disk Insulators (8) Units Contaminated at – X Note Trenton Channel 92" Leakage
⑦ Same as 6 Except Insulators Were Cleaned
⑧ Same as 7 Except Insulators Were Covered With Silicone Compound
40 50 60 70 80 90 100
% Relative Humidity

FIG 1—SILICONE COATINGS increased surface resistance of insulators tested at Belleview service shop. The graph is based on test data

FIG 2—MULTIPLE SURGE COUNTER and dc recording ammeter are set up as illustrated to indicate degree of insulator contamination





Pennsylvania Power & Light Co's New Substation at . . .

Hosensack Joins 220-Kv Systems

WALTER B. MORTON,
Asst. Electrical Engineer,
Pennsylvania Power & Light
Co, Allentown, Pa.

Hosensack, newest substation in Pennsylvania Power & Light Co's 220-kv system, is scheduled for completion next month. The initial part, in operation since June 1953, provides an automatic unattended 75-Mva interconnection with PP&L's 66-kv system. But the new portion includes a section connecting Metropolitan Edison's new 220-kv backbone to the existing 220-kv buses and a 150-Mva connection to ME's 115-kv system.

The new substation is typical of the type "E" design (EW, April 7, 1952,

p 114). It was built in two steps. The first step looped the former 220-kv Plymouth Meeting-Siegfried line through the site. The newly created Hosensack-Plymouth Meeting and Hosensack-Siegfried lines were tied solidly through disconnecting switches to one bus. The 220-66-kv transformer was connected through a disconnecting switch to the opposite bus. A temporary bus tie oil circuit breaker gave the effect electrically of a continuous line from Siegfried to Plymouth Meeting tapped by a transformer to supply the 66-kv substation.

Serves 66-kv System . . . The modern 66-kv switching structure has lines to West Allentown, Freemansburg, and Allentown. It is operating initially as a conventional operating and inspection bus, with provisions for simple change to double breaker design in the future.

Construction in progress will complete the 220-kv switchyard to double-bus double-breaker design with the Plymouth Meeting and Siegfried lines each terminating in a fully equipped bay. The 220-kv buses are being extended to an area where facilities are being installed for Metropolitan Edison Co to supply a 220-kv line to South Reading. Two 75,000-kva transformers will supply their 115-kv substation. The complete stations, 66, 115, and 220 kv, will be fully automatic and will have only one operator who serves as caretaker until an emergency arises.

The general location plan shows the 220-kv yard with the 66 kv-yard opposite and transformer banks between. A mile-long railroad spur passes between these yards and continues on to the 115-kv substation. The entrance road is built into the railroad track.

The PP&L control building is centrally located and contains controls for ME facilities as well. ME will have a small building at its 115-kv substation for relays. A 16,000-gal oil storage tank is placed along the PP&L portion of the spur, with a 500-gal tank for make-up. The same oil will be used for transformers and breakers. All handling will be by highway trailers or tank cars. Filtering and testing will be by portable apparatus. No permanent oil piping facilities are being installed in any PP&L substations.

Strain Bus Features Listed . . . The 220-kv bus has 15-ft phase spacing and spans three bays or 195 ft. The 66-kv bus has 8-ft spacing and spans six bays or 180 ft. Long flying taps to the isolating disconnecting switch structure makes a practical and efficient layout. In some cases outriggers are used on the disconnecting switches to prevent excessive sag in long spans. Features of the strain bus are more ground room, fewer insulators, fewer structures, and a less expensive job than rigid tubing.

Where pairs of disconnecting switches are used, they have been combined in a single structure to reduce both the cost of the switch and the cost of foundations, steel and grading. The two switches have a common post insulator support for two sets of contact jaws. This design has been entirely satisfactory.

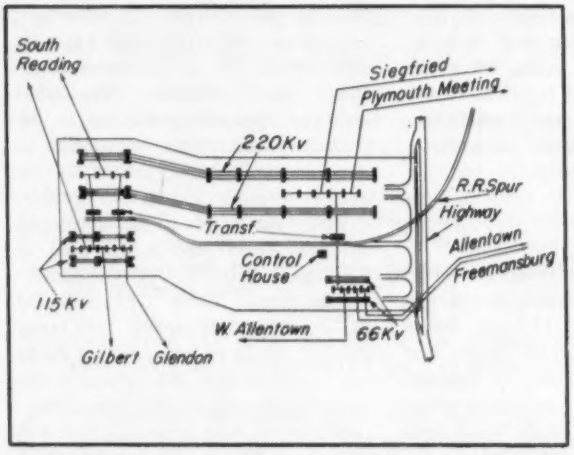
The 220 kv oil circuit breakers at Hosensack are of the watch case design with 10 million-kva interrupting capacity. They will interrupt an arc in 3 cycles and clear a fault and reclose in 20. Each breaker weighs 74,000 lb with oil and stands over 30 ft high.

The arrangement of operating handles for the 3-phase, gang-operated disconnecting switches was determined after tests for safety. Operators operated a switch set up especially for the test. Location of footprints in wet sand determined the area of ground platform required to insure that a man would not accidentally step off and receive a fatal shock.

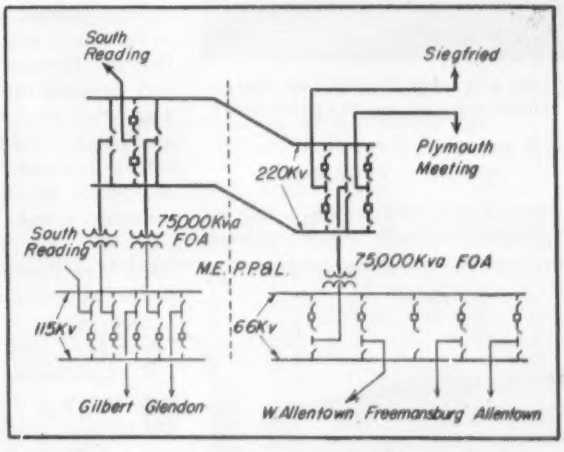
The 220-66 kv transformer sits under a pull-off structure with both 220 and 66-kv lightning arresters placed as close to the terminals as possible for maximum protection. There are no other arresters in the station, but spill gaps are provided on each 66-kv line. The transformer sits on tracks with caster-type wheels. But wheels will be omitted on all future jobs, and the transformers will be repaired in place.

Dual Feed For Pumps and Fans . . . Transformer is rated 75,000 kva FOA and is provided with automatic tap changing under load. It can operate less than an hour with fans and pumps cut off; so dual feed is provided to these pumps and fans. The 12,470-v tertiary winding provides station power and is available for capacitor supply in the future. The 220-kv side is insulated for 196 kv graded to 15 kv at the neutral.

Control building is streamlined to



LOCATION PLAN shows PP&L area at the right. Extension of 220-kv buses serves ME portion. Dog leg in buses keeps 115-kv on high land



SINGLE-LINE DIAGRAM shows double bus-double breaker 220-kv yards. The 115-kv and 66-kv yards have single-breaker transfer buses

reduce cost and still provide for the facilities to go inside. It is a one-story-and-basement structure of cement block construction and has no windows in accordance with PP&L practice. A dehumidification system is provided to prevent condensation and furnish cooling and air conditioning. Heating is from electric space heaters. Lighting is indirect from continuous rows of inverted fluorescent luminaires.

The first floor control room contains 66-kv boards along one side and 220-kv boards along the other. At the end of the 220-kv boards are ME Co control for the South Reading 220-kv line and a miniature control panel for their 115-kv equipment. Switchboards are PP&L standard duplex design with control equipment on the front and relays on the reverse. Space is provided for a future control for a condenser or switched capacitors.

Instruments Are Color Coded . . . The front of the switchboard is designed with U-shaped panels readily removable for interchange of panels or moving or replacing in the future. Instruments, devices, and relays are color coded to make for easy and quick selection and operation with minimum of error. Mimic buses duplicate actual bus setup in the substation controls.

Relay panels are constructed of small sections which permit relay changes to be made with minimum panel rearrangement. Relays are also color coded as part of the color experiment. Carrier current relaying is provided on all 220-kv lines. Lines are reclosed instantly if line is alive and if the synchronizing check relays show synchronism.

Panels are designed with wing walls at the rear for terminal boards to terminate incoming cables and the switchboard wires to which they connect. This vertical arrangement keeps vertical wiring to a minimum and eliminates congestion at the base. Wiring is in packs but colored wire is used. Colors are used indiscriminately, but with only one of a color in a pack it is a simple matter to trace any circuit. Manufacturers say that this colored wire reduces wiring costs of the switchboards.

The basement houses pumps for the water system, 125-v battery for emergency dc control of oil circuit breakers, metal-enclosed power panels and switching for pumps and fan motors associated with the water system and oil cooling of the transformers, and power tools in the area reserved for maintenance. This switchgear also serves the air conditioning equipment. A material handling hatchway permits moving pumps, motors and other equipment in and out with minimum trouble. Expanded metal trays support incoming cables from the switchyard to the proper switchboard termination. Cables are moisture-resistant insulated, neoprene jacketed, and buried directly in earth outdoor for outdoor runs.

Deep Well Provides Water . . . Fire protection system consists of hydrants located in the 220, 115 and 66-kv switchyards and water spray on the transformers. Water is supplied from a deep well by an 8 gpm pump and stored in a 25,000 gal wood-stave tank. Freezing is prevented in the tank by automatic agitation 5 min every hour without heaters. The system is fully automatic. When water is used in fire mains, pressure drops in a 550-gal pressure tank and a 70-gpm pump starts. Operation of the water spray system on the transformers automatically starts a 1,350-gal pump to maintain pressure of 70-85 lbs.

Steel Used for Grounding System . . . Corrosion of underground piping and structures because of dissimilar metals buried in the earth has been reduced by substituting steel for copper underground networks. The network is ½ x 2-in. steel bar with 3/16 x 3-in. taps to structures and equipment. All joints are welded. An inexpensive anodic protection scheme reduces corrosion of the network. The steel bar is not galvanized or painted below grade. The portion at ground level of taps coming up to structures is painted with bitumastic paint, and the section extending above grade is galvanized for weather protection.

The type "E" substation is representative of those where there are very large concentrations of power such as at major generating stations. These substations are usually complete double-breaker, double-bus design and may have switching both at 66 and 220-kv. Usually they include step-down transformer banks at 220 to 66 kv.

Old Design More Expensive . . . An earlier design employed conventional heavy tubing mounted on insulator supports. Bus and taps to equipment were all steel with welded connections. This design, built over 25 years ago, was sound, and little trouble has been experienced with it. However it requires many concrete foundations with each pedestal connected to the ground system. This old design is more expensive, and the many insulators multiply chances of trouble.

Three years ago PP&L developed the new strain bus design used at Hosensack. It is a double-bus, double-breaker design using 1,192.5 MCM ACSR in 195-ft spans for buses and 795 MCM ACSR cable for flying taps to equipment. All fittings in the bus are high compression type. Maximum tension with ½-in. ice and 8-lb wind is 13,500 lb. Maximum sag at 120F is 3.44 in.

75,000-KVA TRANSFORMER has lightning arresters and water spray fire system close by

CONTROL BUILDING with electric heat and air conditioning houses all the switchboards

For New Suburban Areas . . .

12 Kv Has Cost Edge over 4 Kv

Comparison of higher voltages for suburban areas shows that 12 kv has a $10-20 per kva edge over 4.16 kv, depending on load density and choice of subtransmission voltage. Here are conclusions of a study made recently by Pacific Gas & Electric Co:

1. Cost differential between 4.16-kv and 12-kv systems is not necessarily substantial for that part of the system between substations and customers. However 12-kv offers substantial reductions in losses and requires less pounds of conductor.

2. Significant savings of higher voltage distribution rest almost entirely in the substations and subtransmission circuits. This comes from such factors as: Fewer station sites; fewer miles of subtransmission; transformers costing less per kva; fewer high-voltage circuit breakers; and lower switching costs for equivalent service reliability.

3. Aside from the economic side of the comparison, increasing difficulty in obtaining suitable station sites and routes for subtransmission lines to supply residential areas makes 12 kv look better.

4. Furthermore, increasing difficulties from high noise levels in substations are minimized by reducing the number of stations and providing flexibility in the choice of sites. Higher voltage distribution will simplify the obtaining of permits for lines and stations. It should result in a more favorable reaction from the public regarding distribution systems.

CLIVE E. BAUGH, Electric Distribution Engineer, Pacific Gas & Electric Co, San Francisco

Principal distribution voltages today on the Pacific Gas & Electric Co system are 2.4, 4.16 and 12 kv. Most of the former 2.4-kv lines have been cut over to higher voltages, with a marked preference for 12 kv in commercial zones and fringe residential areas. The 4.16-kv voltage is being confined to built-up areas and regions completely surrounded by long-established 4-kv systems.

Growth Areas Converted to 12 kv . . . Fringe areas that indicate substantial load growth and physical suitability are being cut over to 12 kv as fast as necessary to avoid excessive conversion costs in the future. Conversion costs are high—$30 to over $100 per kva of demand. Each conversion project is analyzed carefully to determine whether expected ultimate benefits will justify high initial expenditures.

Overhead 12-kv distribution lines have been used in certain urban and suburban areas for over 30 years. All construction in new subdivision areas is at this voltage. Joint occupancy with California communication companies at 12 kv has been in effect since about 1925, although it was limited to special cases initially.

Present load densities in built-up suburban residential areas are about 2,500 kva per sq mi. This value includes large concentrated loads of suburban shopping centers in some cases. But loads should reach about 5,000 kva per sq mi in the foreseeable future.

In this comparison of 4 kv and 12 kv, only those economic aspects that are affected by the choice of subtransmission and distribution voltages will be covered in detail. Some of the associated physical problems also will be dealt with.

Assume 16-Sq Mile Area . . . Comparisons of subtransmission costs, substation costs, and distribution costs are presented on the basis of 69-kv and 115-kv subtransmission and 12-kv and 4.16-kv distribution. Load densities of 2,500 and 5,000 kva per sq mi for a 16-sq-mi area are assumed. Although this approach is somewhat theoretical, numerous areas on the PG&E system well in excess of 16 sq mi each eventually might be almost entirely suburban.

Voltage Regulation Costs High . . . For some time the excessive substation costs of voltage regulating equipment, particularly at 4.16 kv, have been of concern. Feeder regulators and reactors for 12,000 kva of feeder capacity at 4.16 kv cost from $64,000 to $78,000. But tap-changing-under-load equipment built into a 10,000/12,500-kva, 3-phase transformer costs only about $25,000. In suburban areas, bus regulation has been used successfully for 4.16-kv substations of this size. It is the system standard at 12-kv substations. Recently-constructed 4.16-kv systems have been designed on the basis of bus regulation. But 4.16-kv feeders must be limited in length or additional regulation provided on the feeder to satisfy allowable voltage drops.

Regulation problems at 12 kv are so much less serious that no consideration is given to individual feeder regulation for suburban loads. Cost and other comparisons are based on bus regulation under all conditions. For comparative purposes, maximum voltage drops are limited to 5% or less. Where voltage drop at 4.16 kv would exceed 5%, switched capacitors are used to raise voltage on the feeders.

Make Substations Attractive . . . Nominal amounts have been included in the cost of property to cover ornamental fencing and landscaping. Planning commissions grant use permits more readily if a utility can demonstrate that its stations will be reasonably attractive.

High-voltage switching equipment is held to practicable minimums. Circuit breakers have been omitted where service can be restored after a subtransmission line fault by automatic operation of motor-driven disconnecting switches. Fuses are used to clear faulted transformers where they are available in adequate ampere ratings and interrupting capacities.

Three-phase transformers equipped for tap-changing-under-load and throat connected to metalclad low-voltage switchgear are assumed. Use of metalclad switchgear reduces space requirements and improves station appearance. Transformer ratings have been selected so that remaining units

Area Layouts Show . . .

2,500 Kva per sq mi

1 EITHER OF TWO 69-KV LINES could carry the 40,000-kva area load. Faults on the loop would not interrupt service more than 1-2 min at stations with motor-operated switches. Transformer fuses have 1-million kva interrupting rating

2 ONE 40,000-KVA substation fed at 69 kv serves the area at 12 kv. Transformer primary currents are too high for fuses; therefore, three oil circuit breakers are used so that a faulted line or transformer can be isolated when necessary

3 TWO 115-KV LINES serve the same area load. Either circuit could carry the entire load. Duty at 115 kv would be about 3,500 Mva, thus ruling out use of fuses. Two breakers are required at each station to isolate a faulted transformer

4 SAME LOAD as in Fig 2 is served by two 115-kv lines. With one transformer out on peak, about 13,000 kva would have to be carried by adjoining substations through field switching. But this would not be too difficult at 12 kv

5,000 Kva per sq mi

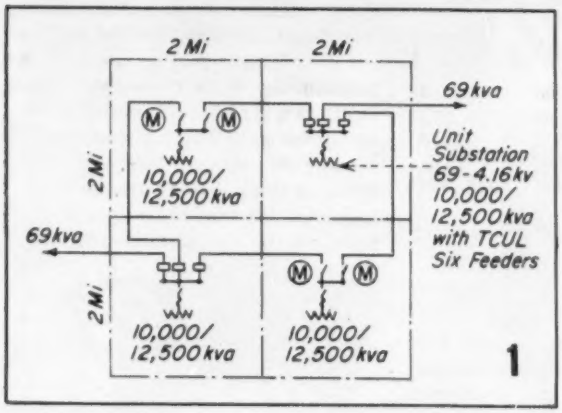
5 THREE 69-KV LINES feed four 4.16-kv substations to serve 5,000 kva per square mile. As in Fig 1, with one substation out of service, the others could pick up the load—at subnormal voltages —by utilizing dual ratings and capability

6 A THIRD 69-KV CIRCUIT is required on an outage basis, compared with Fig 2, as is a fourth breaker to isolate a faulted line or transformer. One unit in either pair could be re-energized by automatic or manual switching

7 ONLY TWO 115-KV LINES are needed to serve twice the load of Fig 3, plus another transformer at each substation. Relays could be used to re-energize unfaulted bank after a transformer fault that takes out one station

8 DOUBLE THE LOAD of Fig 4 requires two more transformers only. If one unit in a pair is faulted, the other could be returned to service by automatic or manual switching. Total load could be carried by the three remaining units

How 4.16-Kv Substations and Subtransmission . . . Compare with 12-kv for Equal Load Capabilities



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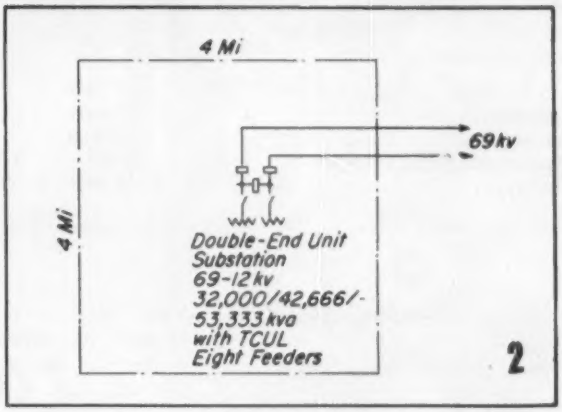

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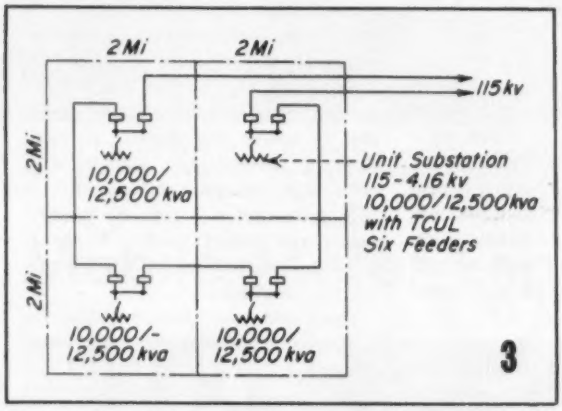

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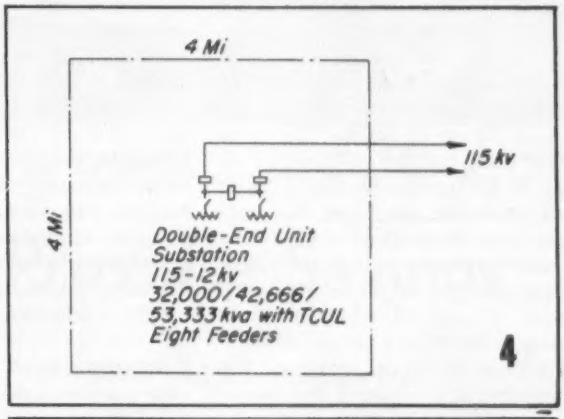

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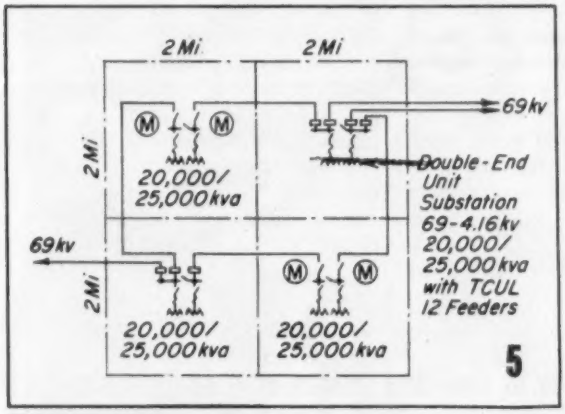

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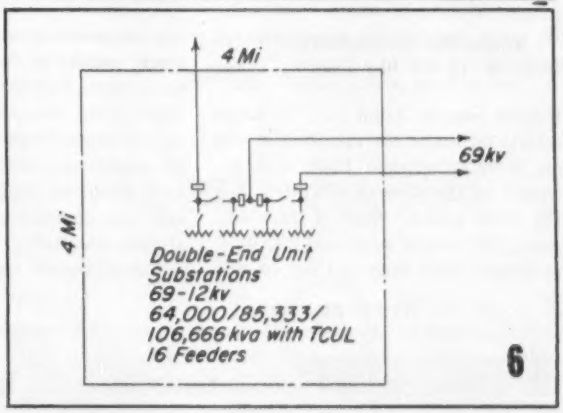

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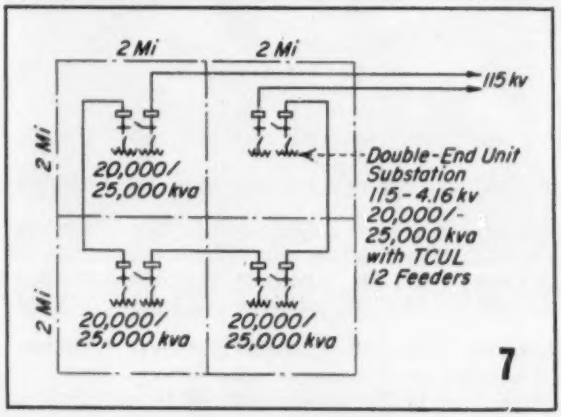

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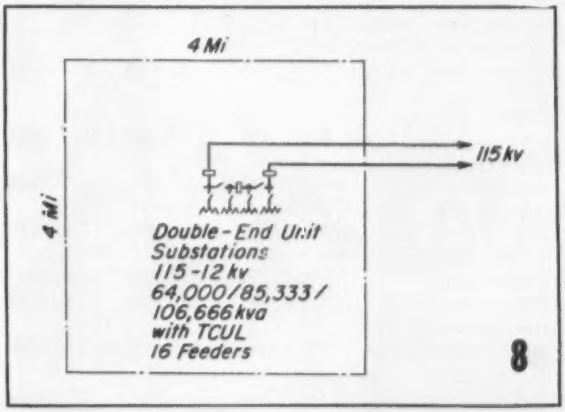


8

Table I—Distribution Cost per Sq Mi Shows Little Savings

Distribution voltage	4.16 Kv		12 Kv	
Load, kva	2,500	5,000	2,500	5,000
Conductor, lb	43,200	77,000	21,800	38,275
Losses, kw	40.5	89.0	35.1	71.4
Maximum voltage drop	4.05%	4.65%	3.38%	4.71%
Cost	$155,000	$245,600	$150,500	$232,200

will carry the full area loads with one unit out of service after field and station switching. Advantage is taken of permissible loading in excess of nameplate rating as covered in the ASA loading guide.

Subtransmission Is 69 or 115 kv . . . The only subtransmission voltages considered are 69 and 115 kv, as no other lower voltages will be used on the PG&E system to supply major new residential developments. Voltages lower than 69 kv do not lend themselves readily to load densities of 5,000 kva per sq mi in residential areas. Ratings of 69-kv lines are taken at 40,000 kva per circuit; 115-kv lines, at 80,000 kva per circuit. For simplicity, it is assumed that supply circuits will have sources available five miles beyond the boundaries of the 16-sq mi area in all cases.

Develop Sample Tract . . . To make realistic estimates for distribution system costs, a sample tract was developed on the basis of 60x150-ft lots with 50-ft streets. Such a tract will have 2,430 lots per sq mi and distributing circuits have been laid out on this basis. There probably would be one or more shopping centers in a tract of this size. But it has been assumed that total load would not be affected in such a way as to alter relative costs appreciably.

Ratings of 4.16-kv circuits are 2,000 kva per circuit; 12-kv circuits, 5,000 kva per circuit. Conductor sizes on trunk lines are based on a reasonable economic balance between losses and carrying charges in accordance with normal system practice. The sizes selected would handle emergency loads—one unit out—without exceeding established thermal limits for the conductors.

Comparison Based on Copper Circuits . . . Distribution circuit costs are based on the use of copper conductor for purposes of comparison. These costs would be lower if aluminum were used. Further reductions might result from innovations such as the use of neutral-supported triplex cable for secondaries. But costs at both voltages would be reduced in proportion and the comparisons would not be altered materially.

Cost estimates are based on the use of 3-phase laterals at 4.16 kv to reduce voltage drop. Single-phase laterals are adequate in so far as voltage drop is concerned at 12 kv. Cost estimates for 4.16-kv, four-wire construction using 2.4-kv transformers are not significantly different than corresponding estimates for three-wire construction using 4.16-kv transformers. Estimates for the 12-kv system are based on the use of three-wire construction only, with 12-kv transformers. And distribution system costs do not include secondaries and services, as these items are independent of primary voltage.

Figure Costs Four Ways . . . With the above background and assumptions as guiding factors, estimates were prepared to show the cost of serving loads of 2,500 kva per sq mi, and of double this density. One-line diagrams showing four ways to serve each load density are illustrated in Figs 1 through 8. Operating requirements and limitations are presented in general in the captions accompanying the illustrations.

Costs and other pertinent data for a distribution system serving a 1-sq mi area with loads of 2,500 kva and 5,000 kva are listed in Table I. Substation and subtransmission costs for the several arrangements illustrated by the one-line diagrams are compared in Table II. Data in the first table must be multiplied by 16 to get figures to correspond with the 16-sq mile areas represented in the second tabulation.

This article was adapted from a recent EEI Transmission & Distribution paper.

Table II—Substation and Subtransmission Costs for 16 Sq Mi Show Real Economy of 12-Kv Distribution

Distribution voltage, kv	4.16		4.16		12		12	
Subtransm. voltage, kv	69		115		69		115	
Load, kva per sq mi	2,500	5,000	2,500	5,000	2,500	5,000	2,500	5,000
Figure No.	1	5	3	7	2	6	4	8
Property and improvements	$112,000	$112,000	$172,000	$172,000	$37,000	$37,000	$62,000	$62,000
High-voltage equipment	322,000	393,000	672,000	708,000	129,000	188,000	239,000	265,000
Transformers and low voltage equip.	628,000	1,344,000	700,000	1,488,000	411,000	821,000	463,000	926,000
Total station	1,062,000	1,849,000	1,544,000	2,368,000	577,000	1,046,000	764,000	1,253,000
Subtransmission	200,000	260,000	250,000	250,000	140,000	210,000	175,000	175,000
Total, stations and subtransmission	1,262,000	2,109,000	1,794,000	2,618,000	717,000	1,256,000	939,000	1,428,000
Total cost per kva	31.30	26.36	44.85	32.72	17.92	15.70	23.47	17.85

MOBILE LABORATORY was constructed by a builder on contract in accordance with Ohio Power Co's specifications. It's the third unit employed successfully by this utility during the past 18 years. Experience with such units suggests their adaptability to other localities

Mobile Meter Lab Provides Savings

Ohio Power and Appalachian Electric Power pioneer with test outfits in field. Economies resulting include time, crew, and materials

J. A. MORRIS, Meter Engineer, American Gas & Electric Co, New York, N. Y.

Story continued on page 92

HI-POT TEST of meters consists of subjecting them to a 1,500-v, 60-cps breakdown test in mobile unit preparatory to re-installment

TEST SPACE within the mobile lab is ample for the work to be done and the comfort of the tester here shown checking meter recordings

Taking the test laboratory to the meter has proved more economical for Ohio Power Co and Appalachian Electric Power Co than sending testers to the meters or the meters to the laboratory.

Sending testers involves personnel with considerable training in handling not only the test equipment and the meter but also live circuits of considerable potential power. Such training may take from six months to a year, and the number of trained testers varies with the size of the area to be covered. Once the tester has been trained, union rules or company policy may require his qualification in a technical category, occasioning more labor expense. Furthermore, system growth is usually accompanied by increased personnel requirements. Such a tester can only report a defective meter which must then be replaced by two servicemen or meter installers and may involve automotive equipment.

The change-out method, involving the sending of servicemen or meter installers to a specific location where the meter is changed and the removed device brought to a central location for test, has its major advantage in the thoroughness of the shop inspection and test on a production line basis. Some state public utility commissions require records of "as found" meter registration which are also of prime interest to meter superintendents. But the accuracy of the "as found" test results of a meter that has traveled any distance in a truck and has been handled several times is at best doubtful.

Usually the changing-out of a watthour meter requires the services of many persons in the company, most of whom have no close connection with the meter department operating accounts. In an extreme case, it could involve an authorization or order clerk, the service department, the addressograph department, a ledger clerk, the billing department, and the meter reading department.

The change-out method may also require additional capital investment in watthour meters over what would normally be needed for additions and replacements. Normally this reserve equals the number of units required to meet the change-out rate which varies from company to company.

Mobile Laboratory . . . Ohio Power's first mobile meter test laboratory unit was designed, built, and put into operation in 1935. Additional units have been built as testing needs demanded, until today the originating company is operating three to maintain periodic test schedules in an area having some 350,000 meters in service. A second company has two and a third one unit. Their present plans call for additional mobile laboratories.

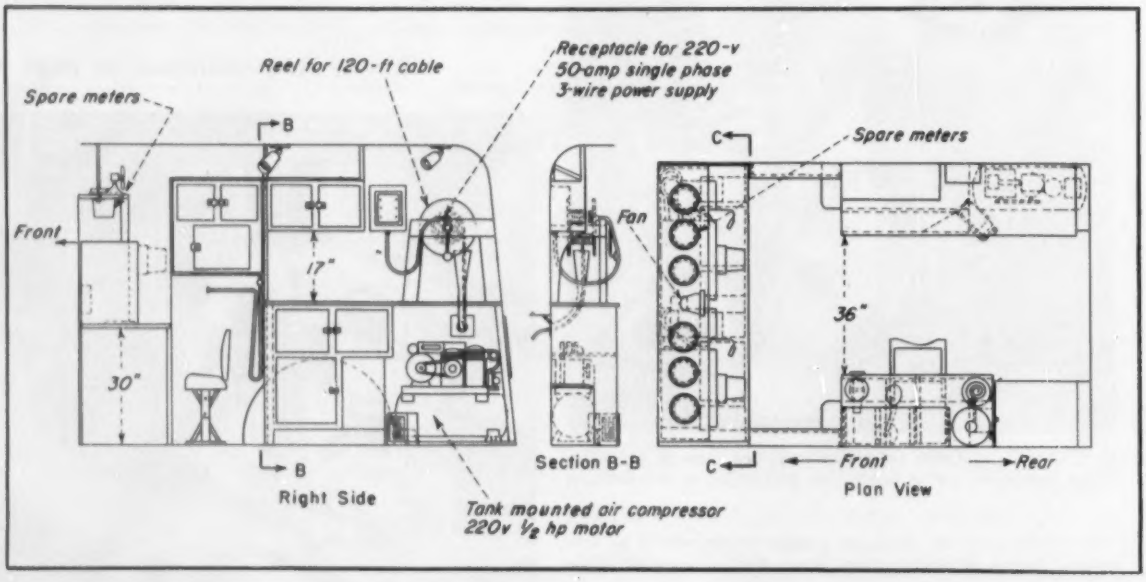
As is to be expected, the units now in use differ somewhat from the original design, the changes being dictated by operating experience and improved tools. Although the design and layout of units in operation are very similar, details differ considerably.

The mobile laboratory idea, it is believed, originated with the Ohio Power Co, and the procedures developed by this utility over the past 18 years will serve to show the potentialities of this method of testing meters. The Appalachian Electric Power Co has had two mobile units in operation for more than two years. Ohio Power's unit is a tailor-made job almost in its entirety, while AEP's was equipped with standard equipment as far as practicable with a minimum of modification.

As cost per unit should be balanced against savings if the expenditure is to be justified economically, the table provides a breakdown of equipment and other costs for one unit, in this case, the most costly.

Operation . . . The territory where these units are in operation has approximately 90% outdoor meter installations. In one company's area, the meters are all Type A in steel enclosures, and in the other practically all are socket-mounted. All are tested on the "area due" system every 96

Meter Test Truck Interior Details, Including General Arrangement,



months. The operating crews consist of four or five men, depending on circumstances, two of whom are classified as Class C metermen and the others as apprentices or helpers.

Test routes are set up by running the meter test slip and a two-part card through the addressograph files which print the customer's name, address, and other pertinent data on both forms. The sequence, as set up by the meter reading department, may include as many as 200 customers.

The pre-addressed test slip and two-part form are issued as a unit to the mobile laboratory foreman. The test slip goes to the tester, and the apprentice gets the two-part form. The latter removes the meters for test in the sequence of the addresses, attaching one part of the perforated two-part card to the customer's meter mounting device and the other to the removed meter. So that service to the customer may not be interrupted more than a few seconds, a special short-circuiting plate is placed in the meter socket while the meter is out for test.

Before removing and disconnecting a meter from an A mounting, a special short-circuiting device is used to prevent service interruption, and the meter is isolated by a special device from the grounded steel enclosure before the energized leads are removed. The apprentice or helper removes four to six meters before returning to the mobile unit. After turning these in for test, he continues his removal work and on his next trip to the unit with removed meters may find tested meters ready for reinstallation.

Meters installed within a short distance of the mobile unit are usually carried to and from the unit. A second automobile, either a station wagon or a sedan, is employed for longer distances. The removers usually arrive at the work location ahead of the testing unit to have removed meters awaiting the unit's arrival. While the unit does not work in stormy weather, it operates at all other times regardless of temperature, ice, snow, or mud.

On Location . . . When the unit is on test location, rough leveling is accomplished by bumper jacks at the four corners of the chassis. Fine leveling is performed by the swivel mounting of the test board.

Power connections for testing and other requirements are obtained by connection to a convenient 120/240-v, single-phase secondary by means of a multi-conductor cable which can be reeled into the truck when moving.

All meters are given a 1,500-v, 60-cps breakdown test before going back into service.

One man in the mobile unit cleans the glass covers and paints those meters requiring it. Small repairs, such as broken covers, peeled or discolored dial faces, stripped screws, and other minor repairs are made after the "as found" test. When a meter is found defective and cannot be repaired by the unit crew, a new meter is installed; and the proper records are forwarded to the accounting department.

In addition to removing and testing meters, personnel frequently work "read-in" and "read-out" orders, investigate customers' complaints, make minor service repairs, and do whatever other work is within the capabilities of the equipment usually available to meter testing personnel.

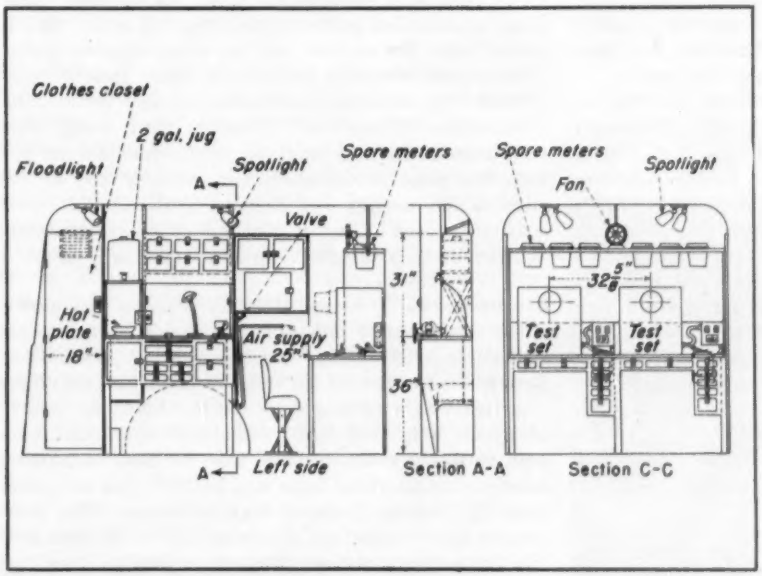
Capabilities of Unit . . . The number of meters tested per day is a variable, depending on the distance traveled to the test location, the condition of the meters, and other factors including highway conditions. The maximum tested in one working day by a five-man crew was 145 units, and 10 to 13 units per day per man are a fair average.

The following breakdown covers eight months' operation:

Average Number of	Per Man Per Day
Tests	7.95
Changes	2.96
Repairs	0.26
Service Jobs	0.20
Total	**11.37**

The above figures were based on 5.18 men working per day during a five-day week for 36 weeks. It was found that work on A base meters furnishes better production figures than work on S base meters other factors being equal.

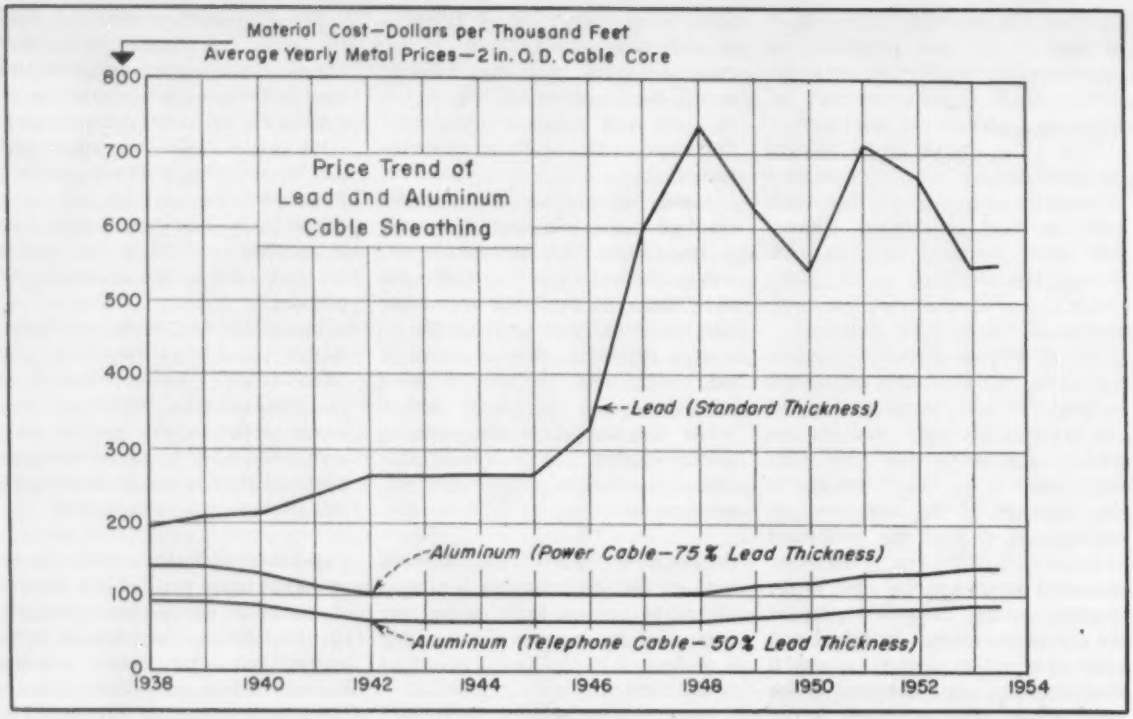
Wiring, Fixtures and Other Equipment



Mobile Lab Cost

	Material	Labor
Transport Equipment	$2,988.09	$826.25
Office Equipment	467.44	500.00
Laboratory Equipment	713.42	715.00
Test Table	2,837.95	125.00
Miscellaneous	226.62	55.37
Total	$7,233.52	$2,221.62
	$9,455.14	

Based on a paper before the EEI-AEIC Meter and Service Committee, Chicago, May 3, 1954



COST COMPARISON of lead and aluminum sheathing illustrates economic incentive that makes the trend to aluminum attractive

Aluminum on Power Cables Forecast

KENNETH S. WYATT, Engineer of Cables, Phelps Dodge Copper Products Corp., New York, N. Y.

Aluminum as a cable sheathing is stronger, lighter, and cheaper than lead, and progress in its processing presages its use in the power cable field and for communication cable for telephone, television (coaxial), and even transocean submarine circuits. Its excellent mechanical characteristics assure longer life, lightness affords easy handling, and low cost per unit volume allows great savings.

The use of aluminum for cable sheathing has been increasing since its introduction in this country in February, 1952. Then 100,000 ft of ⅞-in. and 200,000 ft of 3⅛-in. Styroflex were ordered by the Atomic Energy Commission for Las Vegas and Eniwetok. This cable was precisely made and wound in 1,000-ft lengths on reels.

The combination of aluminum sheath and Styroflex helix, according to a test report by the Naval Research Laboratory, gave a high frequency cable acceptable in mechanical and electrical characteristics. Phelps Dodge Copper Products Corp announced its intention to manufacture aluminum cable sheathing and Styroflex cable under license from Felten and Guilleaume, Cologne, Germany, but the first order was imported from Cologne.

Since then, aluminum-sheathed cable has been employed in the Continental Defense Warning System and has been in demand where a high quality coaxial cable for high frequency is required.

The company's coaxial cable plant at Yonkers, soon after its installation, turned to sheathing power cables with aluminum. Some 5,000 ft of three-conductor cable in the 15-kv range and some 15,000 ft of triplexed one-conductor 27-kv cable have been manufactured and installed. Additional quantities of power cable are now on order. Usually power cable for outdoor use has a polyethylene jacket.

Aluminum sheathing has already made great progress in both high frequency communication and power cable fields, from ½" to 6⅛" diameter, there being some 4000 units in Great Britain and the Commonwealth, perhaps 500 miles in Germany, and probably 200 to 300 miles in this country and Canada. Although the recent activity has been in Europe, first uses of aluminum sheathing were on U. S. dirigibles Akron and Macon in 1932.

Economics . . . To have a profound effect on an industry, a new development must afford a strong economic advantage or offer marked improvement in performance. Both forces are behind the trend to aluminum sheathing.

A unit weight of aluminum has 4.2 times the volume of a unit weight of lead. Aluminum is stronger than lead, so that a lesser thickness may be used. Aluminum sheathing on telephone cable can be 50%, and on power cable 75% of the required lead thicknesses. The comparative cost of metal for sheathing 1,000 ft of cable core 2 in. in dia, using average yearly prices in The Metal Sta-

Adapted from a paper delivered at the American Power Conference, Sherman Hotel, Chicago, Ill., March 25, 1954.

tistics Handbook is plotted on the opposite page.

There is a relative lack of fluctuation in aluminum prices, but lead prices climb sharply. The highest price for lead used in these curves was 17¢ per lb. In 1952, the cost of aluminum sheath on power cable was $130.00, compared with $680.00 for lead. The material cost for 1 ft of sheath of 1-in. dia telephone cables was: for lead at 1951 prices, 22¢; for Stalpeth (steel aluminum foil and polyethylene), 12¢, and for aluminum, 2¢.

These costs, however, belong to the future. At present, the labor involved in the current draw-down method of manufacturing power cable sheathed with aluminum keeps its cost level with cable sheathed with lead.

The telephone cable industry uses 125,000 tons of lead, or the equivalent in stalpeth sheath, each year which at 13¢ per lb costs $32,500,000. Aluminum at 20¢ per lb would cost only $6,000,000. Disregarding application costs, the material saving each year is $26,500,000.

Aluminum and Lead Properties . . . The properties of aluminum, both electrical grade and super-pure, are compared with those of lead and copper in Table II. The table shows the superior tensile strength, fatigue endurance, and creep resistance of aluminum.

Both lead and aluminum have a face-centered cubic structure characterized by a high degree of ductility and ease in working. But the grain size of aluminum is many times smaller and more uniform. Recrystallation of aluminum does not occur within the operating temperature range of cables, as it does for lead. Recrystallation may take place in lead at room temperature. In super-purity, cold-worked aluminum it occurs at 100 C or less and in E. C. grade (cold worked) at 300 C.

The effect of the drawing-down process on the properties of aluminum tube is shown in Table III. The chief effect is in proof stress and elongation. The elastic modulus is little affected by cold working or by purity.

Compared with aluminum, lead is admittedly far easier to apply to a cable as a sheath. It has a long plastic temperature range, is soft, and is readily extruded at temperatures which do not affect the cable insulation (200-250 C). But the extrusion of aluminum directly onto the cable has exercised engineering thinking for more than 20 years and is only now becoming a practical reality.

Corrosion . . . Occasionally lead in soils containing organic refuse is attacked by corrosion or bacteria. Aluminum is resistant to these. Nevertheless, aluminum for underground burial and some outdoor installations requires protection. Aluminum is chemically active and can be used commercially only because it forms a thick nonporous resistant film of oxide.

As this oxide film dissolves in alkalies, it is sometimes protected by zinc or other chromates painted over the aluminum. Moisture penetrating the outer protective painting dissolves some chromate and reoxidizes the aluminum, thereby renewing the protective film. In general, corrosive action on aluminum is particularly bad in soils containing chlorides or alkalies, or in concrete ducts.

Super-pure aluminum has much better corrosion resistance than any other grade or any alloy of aluminum.

Manufacture . . . Aluminum sheath is applied by these three methods:

1. The draw-down method, in which the cable is threaded into a 10% oversize aluminum tube which is then sunk snugly onto the cable.

2. The strip method, in which an aluminum strip is formed around the cable and the longitudinal seam butt-welded by high frequency induction, or by twin-arc welding under argon.

3. The hot-extrusion method, in which the aluminum is applied to the cable directly.

The draw-down method is the only one used commercially to any extent. Johnson and Phillips in England employed it in pioneering with aluminum cable sheathing, and up to now it has produced about 5,000 miles.

The Yoder Co, Cleveland, Ohio, using high frequency induction, and the Pirelli-General Cable Works in England, employing twin arc welding, are pioneering with the strip method. A strip process was developed as long ago as 1927 in Germany, but proved unsuccessful.

The Yoder process applies sheath up to 120 ft per min. It has a low capital investment and high output, and should be satisfactory for small cables with non-hygroscopic insulation, such as rubber, polyethylene or pvc. Occasional porosity at the longitudinal seam of aluminum has not so far been completely eliminated.

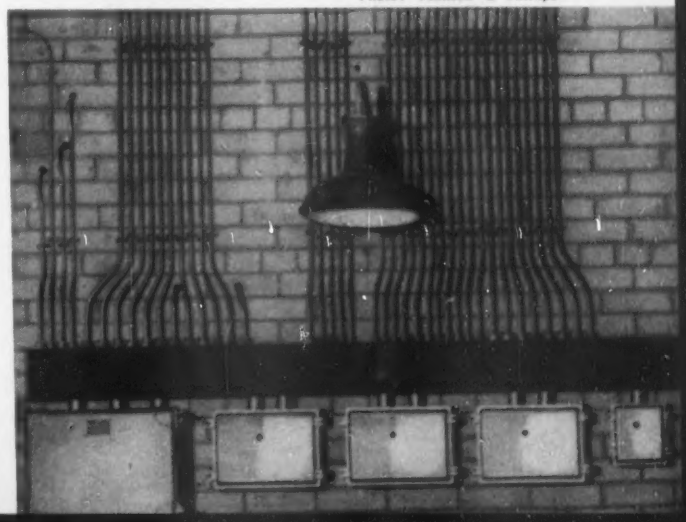
Hot extrusion, the goal in Germany for nearly 20 years, is the ultimate method. The great difficulties of the method appear to have been overcome, and several large presses are about ready for commercial production. The largest press is that of Felten and Guilleaume at Cologne, employing two rams, each 4,950 tons. This went into experimental operation Nov. 10, 1953, and the British Alsheath, in June 1954 (see EW, July 5 p 59). A 1,000-ton, high-temperature press has also been built by Schloemann and operated at their factory in Osnabruck.

These presses should be successful, their only drawback being a heavy initial investment. Hot extrusion of aluminum is difficult because it requires temperatures up to 560 C. The steel press reacts and oil-paper insulation chars rapidly at 350 C and deteriorates at 300 C.

Sheath Thicknesses . . . As Anderegg found in establishing thicknesses for lead, the limiting factor in the use of aluminum is the wrinkling that occurs when it is wound on a standard reel. On a basis purely of mechanical strength, thicknesses could be appreciably reduced for many purposes. Thicknesses now used by Phelps Dodge

ALUMINUM-SHEATHED control cables installed in a new generating station in the British Isles. Note the training and support details

Photo: Johnson & Phillips



Tables Show Aluminum Sheath Requires Less Thickness

Table I—Aluminum Sheath Thicknesses—in Mils

Diameter Core (Inches)	Lead (AEIC)	Aluminum With Jacket Aluminum	Poly-ethylene	Aluminum (Without Jacket)
½	80	50	80	50
1	90	50	80	60
1½	105	60	85	80
2	120	80	90	100
2½	135	100	100	120
3	145	115	105	140

Table II—Properties of Aluminum, Lead & Copper*

Property	Pure Lead	Alumi-num 99.99%	Alumi-num 99.5%	Copper O.F.H.C.
Elastic Modulus lb./sq. in. 2×10^6	2	10	10	17
Tensile Strength lb./sq. in.	2200	5600	12700	31000
Yield Point (or 0.1% Proof Stress) lb./sq. in.		2200	4200	6700
Elongation Percent	30	45	30	60
Brinell Hardness	3.5	15	20	42
Fatigue Limit lb./sq. in.	670	3300	4500	9700
Stress to give creep rate of 0.1% per yr.—lb./sq. in.	100	1100	1000	.....
Electrical Conductivity IACS	8	64	61	102
Thermal Conductivity (C.G.S. Units)	0.082	0.57	0.53	0.92
Specific Gravity	11.34	2.70	2.70+	8.91
Melting Point °C	327	660	658.7	1081
Coefficient of Thermal Expansion Per °C $\times 10^{-4}$	29	23.5	23.5	17

*Latin, A., "Metallurgical Considerations in the Use of Aluminum for Cable Sheathing," Metallurgia, October, 1951.

Table III—Effect of Drawing on Mechanical Properties

	Circumferential Tests			Longitudinal Tests		
% Reduction of Tube Dia.	Tensile Strength ton/sq. in.	0.5% Proof Stress ton/sq. in.	Elongation %	Tensile Strength ton/sq. in.	0.5% Proof Stress ton/sq. in.	Elongation %
None	4.27	3.45	32.5	4.11	3.47	35
15	5.08	5.05	10	5.54	5.5	10
26	5.13	5.08	10	5.9	5.8	10

Table IV—Melting Point of Tinning Materials

Tin	232 C
Zinc	419 C
Eutectic: 90.5% zinc	197 C
Cadmium	320 C
Eutetic: 82.3% Cadmium 17.7% zinc	270 C
Eutetic: 68.9% tin 31.1% cadmium	177 C

are given in Table I, lead being included for comparison.

As an extruded polyethylene jacket contributes considerable mechanical support to aluminum, thinner walls of this metal may be used with such a jacket. As a rule, all power cable has such a jacket. The third column of Table I gives the effective thicknesses of aluminum cable sheath. Extruded polyvinyl chloride or wrapped protective covering do not permit reduction of metal thickness because they relax and do not give permanent support.

Extruded aluminum sheathing, not being cold worked as in the drawdown process, has greater flexibility. The thicknesses in Table I will probably be modified when more experience is gained with aluminum-sheathed cable.

Phelps Dodge supplies a polyethylene jacket of the thickness given in Table I. Pvc, either wrapped or extruded, is used in Germany. Johnson and Phillips apply a pvc wrap protected by a Fibreglas bitumen-saturated tape and with a hessian tape overall.

Bending Diameters . . . Aluminum-sheathed cable, it has been claimed, can be wound on any reel that a lead sheathed cable can be wound on, such as a radius of 12 cable diameters. But winding cable on such a reel is extremely difficult. Johnson and Phillips use such a reel for 1¼-in. dia and smaller cable. Phelps Dodge uses reels 15 times sheath diameter.

In manholes cables as large as 1-in. dia may be trained on radii equal to 12 diameter and larger cables to 15 diameter. When cable is pulled around bends, the minimum radius should be 30 diameter. For making bends during installation, well designed bending and straightening tools can give a neat appearance.

Joining . . . When aluminum sheath is properly tinned, the usual wiping techniques are satisfactory. For tinning, various mixtures of tin and zinc, cadmium and zinc, and tin zinc and cadmium have their advocates. A little copper, silver, aluminum, bismuth and even lead are sometimes added to the mixtures. None of these additions has shown any material benefit.

The 90% tin-10% zinc is weak against corrosion, and clean tinning is difficult to sustain during wiping. Cadmium-zinc affords a very strong bond and is much more resistant to corrosion, but the working temperature of 300 C is apt to burn the insulation. The melting temperatures of these mixtures are given in Table IV.

Phelps Dodge is using a mixture of tin, zinc, and lead (77.18, 20.47, and 2.25%) with success. The sheath must be free from grease, no stearine or tallow should be used, the oxide film must be removed with a file or wire brush, and the sheath must be rubbed vigorously with the tinning solder stick while the sheath is being heated by a gas torch.

Protecting Joints . . . Wiped joints on aluminum sheathing are satisfactory for dry indoor locations and, possibly, some outdoor locations. Because aluminum is high in the electromotive series, an appreciable potential is set up between the aluminum and tin or lead (zinc and cadmium are sacrificial to aluminum, or rather, to its oxide). In the presence of traces of moisture, deterioration sets in at the interface and rapidly travels along until the joint

Lasts Longer, and Needs Less Support and Maintenance

falls apart. This action is aided by the high bulk of aluminum oxide which, once formed, exerts a prying action, opening up the interface for fresh attacks. When placed in a high humidity atmosphere at 90 C, any wiped joint on aluminum sheath falls apart in a few days or weeks. All tinning mixtures give similar results at the aluminum interface, the best being cadmium-zinc which may last 10 days to a month. Extrapolated by experience to a wet manhole, these tests indicate the life of wiped aluminum joints is six months to a year for tin-zinc, and two years for cadmium-zinc.

Consequently, aluminum-sheathed cable for wet outdoor locations should be protected at the interface by a layer of zinc chromate paint which in turn is protected by a layer of moisture-impermeable paint or plastic, such as polyethylene. Even these should be depended upon only when the wipes are inspected periodically. They will not give a 30-year life.

British manufacturers who use tar over their alumium cables, claim that they have experienced no distintegration of wipes. Their experience can probably be explained by the fact that tar keeps out moisture and electrolytes. Probably a mechanical joint, or an aluminum to aluminum hot or cold weld will end the disintegration problem.

Cast plumb, rather than conventional wipes, were used on the recent 200-psi aluminum-sheathed 69-kv cable at Vancouver. The cast plumbs made it possible to employ the eutectic of tin and lead (62% tin, 38% lead), and, in conjunction with the better stress distribution of the cast union, insured freedom from gas leakage.

Supports and Applications . . . The greater rigidity of aluminum-sheathed cable allows two to three times longer spacing between supports than for lead cable. Johnson and Phillips recommend 3 ft 6 in. to 6 ft for cables smaller than 1¼-in. sheath dia and 5 to 8 ft for larger cables.

As the aluminum sheath in industrial applications is really the conduit, the sheathed cable represents a combination cable and conduit. When it is trained neatly on factory walls, as illustrated, sheathed cable is sufficiently rigid to be semi-self-supporting for short runs. Considerable savings can be effected through the elimination of the labor of installing, threading and coupling the conduit and pulling the wiring into it. This is a particularly successful application of aluminum-sheathed cable.

Aerial Cables . . . Lead is the heaviest of the common metals. On the other hand, aluminum is the lightest and found its first use as cable sheathing on dirigibles. These facts indicate the advantages of aluminum over lead for aerial circuits on poles. The saving in weight runs from 20 to 70%. Labor costs of installation may be considerably reduced, and messenger wires and pole hardware need not be so heavy.

Underground Cable . . . Aluminum-sheathed cable buried in the ground requires the protection of a corrosion-proof jacket. The hard, high-strength sheath needs no re-inforcement. Consequently, aluminum-sheathed cable is economically attractive compared with lead cable which usually requires armoring.

Aluminum-sheathed cable has a larger training radius than lead cable. Consequently, it may require larger manholes when the cable is installed in ducts.

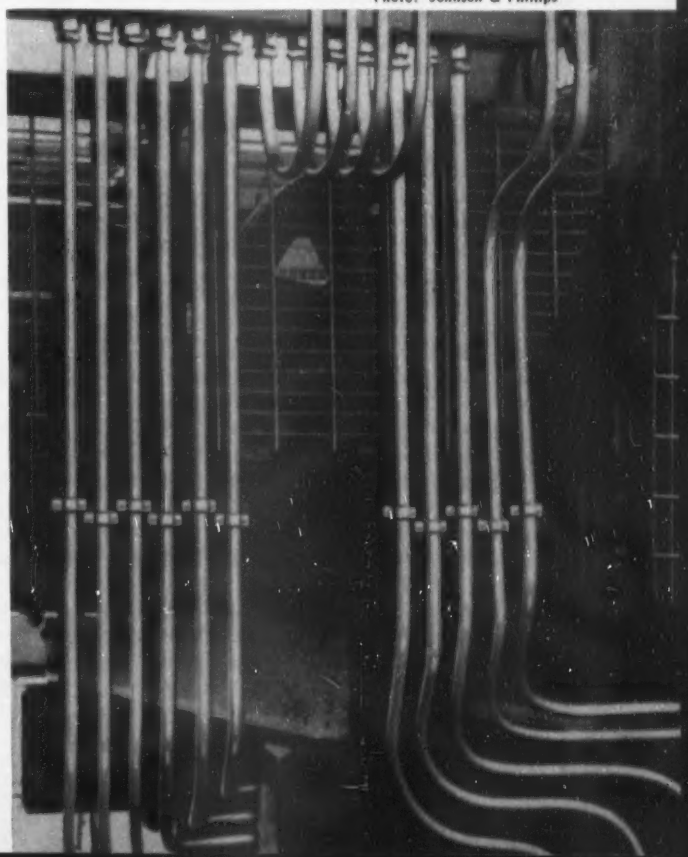
Despite the fact that the coefficient of expansion of aluminum is 15 to 20% less than that of lead, the wipe at the joint is subjected to appreciable strain in the present standard manholes. This strain accelerates corrosion at the aluminum interface. A triplexed single-core cable in which expansion thrust and movement are very greatly reduced is one solution to this problem.

Sheath losses on duct cable with large-size copper are another important problem. Even on three-conductor cable, these sheath losses may become appreciable because of the high conductivity of aluminum.

Extra-High Voltage Cable . . . At voltages of 138 kv and higher, the trend is toward the use of a high internal pressure cable. Only the expense and the difficulty of re-inforcing a lead sheath for 200 psi and of jointing and terminating it, have held back higher pressures on Pirelli oil-filled cable.

Without any re-enforcement, aluminum sheathing withstands internal pressures of this magnitude without creep. This fact suggests the possibility of constructing a high pressure cable, either oil or gas filled, that would be reliable and economical. It may be very economical to extrude an aluminum sheath over three cable cores, instead of laying steel pipe and pulling the cable into it.

ALUMINUM-SHEATHED rubber cables in switch room of new electric generating station of the British Electricity Authority, Great Britain.
Photo: Johnson & Phillips



Spreading Courtesy Throughout Florida

Mayor Abe Aronovitz of Miami places a driving courtesy sticker on the bumper of his car. Assisting him is Mrs Juanita Lynskey, president of the Dade Business and Professional Women's Club, one of the groups throughout the state sponsoring traffic courtesy. Such campaigns got their start when Florida Power & Light Co issued to its employees 5,000 of the stickers, printed in luminescent ink and bearing the message, "In Traffic, As Always . . . Do Unto Others." The public clamored for them. Now over 40,000 of them have been distributed, 90% at request of civic and church groups.

Departing Customer Gets Card of Introduction

Southwestern Public Service Co has arranged a pleasant good-bye for customers leaving its territory. It has prepared a small card of introduction which the customer can use in getting service in the area to which he is moving. The copy reads:

"To business-managed electric companies across the nation! Reddy presents Mr (customer's name), a Reddy Kilowatt customer, whom we have had the pleasure of serving in (name of city and date). Your assistance in helping him establish his residence in your community will be appreciated. Southwestern Public Service Co, (signature) manager."

A. R. Watson, vice president, says, "The card is basically a customer relations vehicle but is also an excellent credit reference. The manager in the new location will know from the fact that the customer has the card that he left his old location in good standing."

Customer reaction has been favorable.

A Penny Will Do It

The low cost of electricity is dramatized in a 24-page, 4¼ by 5½-in., booklet just published by Consolidated Edison Co of New York. Each page carries a photograph of an appliance in use, and the brief caption tells how little it costs to run. Example: Two teen agers are sitting on the floor on which are spread about 50 records. The copy reads: Platter party. John and Mary can have 5½ hours of fun with these records. Cost for electricity for all that entertainment? Only 1¢!

Better Living TV Show Lists Coming Programs

Additional programs for the "Better Living Television Theater," which is telecast at 10:30 PM (EDST) each Sunday over the DuMont Television Network, include:

Aug. 2—Elmer L. Lindseth, president, Cleveland Electric Illuminating Co, and Clare Fulton, manager, Marketing Street Lighting Division, General Electric Co. Film: "Out of Darkness."

Aug. 9—Bayard L. England, president, Atlantic City Electric Co, and James M. Symes, president, Pennsylvania Railroad. Film: "Tomorrow Is Now."

SCANNING THE ADS

Alabama Power Co—"Mister, These Actions Are Dangerous!" was the head on an educational ad. Four types of danger from power lines were illustrated, and instructions were given on how the dangers could be avoided. The dangers were: 1. A boom of a movable crane coming into contact with one. 2. A TV antenna coming in contact during erection or in falling after it has been erected. 3. Touching fallen lines. 4. Chopping down trees so that they fall against a line.

Electric Companies Advertising Program—"New products, more power ready for your family" was the head on an ad illustrated by an electric kitchen, television receiver, home air conditioning, and a home workshop.

Kansas Gas & Electric Co—"Butter was a problem in the 'good old days' B.E. (before electricity)." Illustration showed mother lowering butter into the well to keep it from melting. Copy promoted electric refrigeration.

Metropolitan Edison Co—"Enjoy yourself while electricity . . . does the hard work (copy promoting the electric washer-dryer combination) . . . does the hot work (copy promoting the electric range) . . . does the unpleasant work (copy promoting the electric dish washer and water heater)."

WASHINGTON COMMENT

JESSE MOCK

Republican power policy faces a crucial test in the Oregon Senatorial campaigns which are scheduled to get under way in earnest during the next few weeks.

Advocates of the New Deal brand of federal paternalism in the power field are set to roll out their big guns against incumbent Republican Guy Cordon, who is one of the most influential men in Congress in guiding power policy.

Cordon vs Neuberger: Big Dam Boys With a Difference

As chairman of the Senate subcommittee on Interior Department appropriations and more recently as chairman of the Senate Interior and Insular Affairs Committee, Cordon holds a powerful and unique position in setting legislative policy and providing funds to carry out Western resource development.

Although he sometimes describes himself as a "simple country lawyer," he is easily the most knowledgeable legislator on the Hill with regard to federal power matters. People who have dealt with him—representatives of both public and private power—are impressed with his reasonableness and fairness.

Neuberger Opposes GOP Power Policy . . . Out to knock off Cordon is Richard L. Neuberger, a Democratic state senator and a prolific writer on Pacific Northwest subjects. If he has his way, the central issue in the Oregon Senatorial fight will be public vs private power.

In articles for such publications as Harpers, the St. Louis Post-Dispatch, Frontier, The New Republic and The Progressive, Neuberger has been shaping up this issue for presentation to the Oregon voters. His articles on Republican power policy and on Cordon appeared under such titles as "Power Grab!", "The Tomahawking of Bonneville (power administration)", and "The Senator Behind the Giveaways." Sometimes Neuberger has indicated in the articles that he has a personal political stake in the issues. At other times the issues have been presented as the comments of a more or less objective observer in the area.

Besides campaigning in the public prints, Neuberger is also making a round of public appearances. Up until now Neuberger has had the stage pretty much to himself. Cordon has stuck close to his legislative duties which are the most demanding in his ten years of Senate service. But the senior Oregon Senator has no intentions of shying away from a knock-down, drag-out fight with the hard-hitting Neuberger. And the power issue suits him better than any other on which to pitch a campaign.

Cordon Has Backed Big Dams . . . Much as Neuberger would like it, he'll find it impossible to pin a "strictly private power" label on Cordon. For while Neuberger and his cohort, Independent Sen Wayne Morse, have been shouting of the glories of federal contributions to Northwest power, it has been Cordon who has engineered the multi-million dollar appropriations year after year that have built some of the largest power dams in the world and federal transmission facilities that in some ways outshine the Tennessee Valley Authority system.

Without Cordon's personal influence, such power dams as The Dalles and McNary which are now a-building would still be no further than the drawing boards. Without an assist from Cordon, the construction program for most of the Columbia Basin projects could very well have entirely bogged down from lack of appropriation authorizations.

There is a well-defined and deep-grained difference between the two contestants for the Oregon Senatorial seat. Cordon believes that the federal contribution to area power should be limited to what local public and private groups are unable to provide for themselves. Neuberger backs the New Deal philosophy, which appeared headed toward federal domination of power supply and transmission in the Northwest.

Oregon is well accustomed to voting for Republican Senators. The last Democratic Senator to come from that state was elected in 1914. Thus a win for Cordon will be something less than a clear-cut indorsement of Republican power policy. However, a win for Neuberger would be a powerful strike against the Eisenhower Policy and could send more timid Republicans scampering for a safer berth.

TECHNICAL NOTES

ARCHER E. KNOWLTON

Ethylene glycol terephthalate varnished tapes have withstood (without any sign of cracking) folding and creasing after 1,000 hours aging at 150 C.

Radio-wave propagation through the atmosphere becomes progressively more severely handicapped by oxygen, rain, and water-vapor absorptions at frequencies above 12,000 megacycles.

Concrete is useful as a radioactive shield for nuclear reactors. Conversely radioactive materials are useful in detecting non-uniformity of concrete after placement but before it sets.

Silvered aluminum bar joints require no more preservation or attention than silvered copper when used for switchgear and in an atmosphere of clean, dry air.

Many metals and alloys when exposed to mildly corrosive environments in a stressed condition will develop cracks.

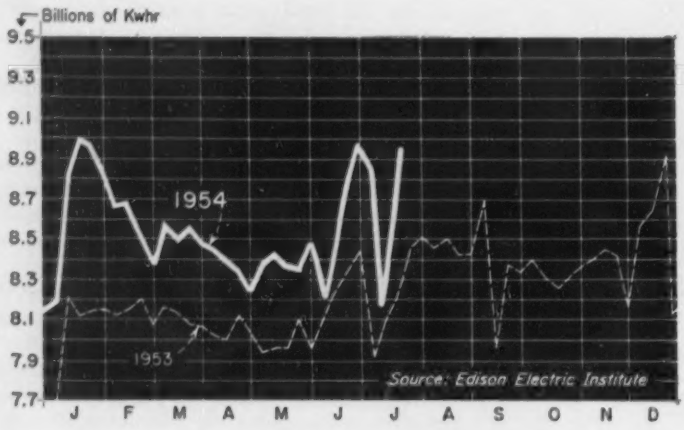
Puffs of stack emission are less likely if precipitators are rapped automatically 24 times a minute rather than once in 24 minutes or 24 hours.

Freeze-prevention of "cold" water piping (up to 2 inches) is pretty well assured by applying electric heat of 65 w per lineal foot with an insulation of fibered glass.

Meters and instruments need superior dust protection in a cement plant and in such utility construction operations as gunniting a coal hopper passing above switchgear.

Strip of foil hung over a bus will diverge and thus act as a warning when the bus is energized. Care must be taken to prevent short-circuiting by the foil.

STATISTICS



Output Week Ended July 17—8,951,000,000 Kwhr

Seasonally Adjusted Index†=178.4

Per Cent Change From Previous Year

	Total US	New Eng.	Mid. Atlan.	Cent. Ind.	West Cent.	South-east	South Cent.	Rocky Mount.	Pacific NW	Pacific SW
July 17	+9.0	−0.2	−0.3	−1.6	+16.1	+20.7	+28.7	+6.1	+3.4	+3.8
July 10	+1.1	−5.1	−7.8	−9.8	+7.6	+13.2	+9.1	+4.8	−1.1	−0.9
July 3	+11.5	+10.0	+3.9	+4.9	+18.5	+28.4	+11.5	+9.0	+8.4	+8.2

Electric Power Statistics

		Latest Month	Preceding Month	Year Ago
Peak Load‡ (Million Kw)	May	73.8	73.7	70.7
Capacity (Million Kw)	May	93.81	93.56	84.34
Production (Billion Kwhr)	May	37.43	36.84	36.02
Hydro	May	10.35	9.91	10.29
Fuel	May	27.08	26.93	25.73
Fuel Consumption				
Coal (Million Tons)	May	8.67	8.68	8.59
Oil (Million Barrels)	May	4.25	4.78	6.08
Gas (Billion Cu Ft)	May	94.70	91.10	87.85
Sales (Billion Kwhr)	Apr.	32.31	32.53	31.75
Residential	Apr.	9.93	10.15	8.86
Commercial	Apr.	5.62	5.60	5.15
Industrial	Apr.	14.60	14.67	15.46
Other	Apr.	2.17	2.10	2.28
Net Income Class A & B Companies ($ Million)	Apr.	96.05	94.29	87.29
Estimated Dec. '54 Peak ‡(Million Kw)	May	88.1	88.4	91.8
Kwhr per Residential Customer (12 Month Average)	Apr.	2,415	2,398	2,226
Revenue per Kwhr Residential Service (12 Month Average)	Apr.	2.72¢	2.72¢	2.76¢
Canadian Production (Billion Kwhr)	Apr.	5.65	5.77	5.74

Business Statistics

FRB Industrial Production Index†	June	124*	123	136
Gross National Product Annual Rate ($ Billion)	1stQtr.	357.8	363.5	363.9
EW 4 Industry Production Index	Apr.	115.1	116.7	126.5
ENR Construction Cost Index††	June	130.5	129.7	124.4
BLS Consumer's Price Index	May	115.0	114.6	114.0
NEMA Insulation Materials Sales Index†	May	116	124	174
NEMA Electric Appliance Sales Index†	May	88	96	108
NEMA Household Refrig. Sales Index†	May	74	73	81
Metal Prices (July 20)				
Copper, Conn., V., lb		$.30	.29¾	.29¾
Lead, N. Y., lb		.14	.14	.13¾
Zinc, prime Western S. St. Louis, lb		.11	.11	.11
Tin, Straits, qual. N. Y. lb		.97½	.93½	.79¾
Aluminum, ingot, base price		.21½	.21½	.21½
Nickel, base price		.60	.60	.60
Steel, billets, Pitts., ton		62.00	62.00	62.00
Steel, scrap, No. 1 heavy, Pitts., ton		28.00	29.00	43.00

*Preliminary **Revised ‡Class 1 Systems †1947-49=100 ††1949=100

Big Increase in Peak Load by 1975 Seen by FPC

Federal Power Commission report issued this month estimates that peak loads of larger electric utilities in the United States will increase from a total of 80 million kw in 1953 to nearly 250 million kw in 1975.

Annual energy consumption will jump from about 440 billion kwhr to more than 1,350 billion kwhr in the same period, according to the FPC estimates. (See Table I.)

Load estimates in the report, "Estimated Future Power Requirements of the United States by Regions, 1953 to 1975," are based on Class I utilities and the smaller systems they supply. This coverage represents 97-98% of total electric load.

The FPC estimates indicate home use of electricity will grow possibly at a slightly faster rate than other categories. (See Table II.)

The FPC report notes that the estimates for the 22-year period represent a greater sustained growth than any period in the past.

Copies may be purchased from Publications Division, FPC, Washington 25, D. C. Price is 20¢ per copy; order number is FPC P-27.

Table I Projections of Loads by FPC Regions Class I Utilities

(Energy in billion kwhr; peaks[1] in million kw)

	1953		1975	
Region	Energy	Peak	Energy	Peak
Northeast	100.3	18.9	236.0	45.2
East Central	82.6	14.5	260.6	46.0
Southeast	73.7	13.4	278.6	49.2
North Central	54.1	10.3	168.4	31.6
South Central	39.7	7.4	120.3	22.7
West Central	7.3	1.5	26.2	5.2
Northwest	38.6	6.5	122.0	20.9
Southwest	42.3	7.5	144.2	27.4
United States[2]	438.6	80.0	1,356.3	248.2

[1] Annual peaks as distinguished from calendar year peaks; peaks for some areas occur during summer months.

[2] Peaks for U. S. represent arithmetical sum of annual peaks for regions.

Table II Energy Requirement of Class I Utilities

Class of Use	Billion kwhr 1953	1975
Farm excluding irrigation and drainage pumping	14	46
Irrigation and drainage pumping	6	10
Non-farm residential	83	277
Commercial	69	203
Industrial (including atomic energy loads)	196	615
Other deliveries to ultimate customers	20	44
Losses and unaccounted for energy	51	161
Total energy requirements	439	1,356

New Revenue Bill Analyzed...

...by Ebasco report. It shows the effect of the new tax depreciation provisions on the electric and gas industry

The effect on the electric and gas utility industry of the new tax depreciation provisions in the Revenue Bill of 1954 is analyzed from several important aspects in a comprehensive report, shortly to be released by Ebasco Services Inc.

The report first outlines briefly Congressional intent with respect to the new provisions of tax depreciation. The main purpose is to stimulate the national economy by providing funds for investment in industry through the temporary deferral of federal income taxes. The report also points out that one of the collateral advantages of using such liberalized methods of tax depreciation lies in the partial protection of the taxpayer against early obsolescence by the amortization of a substantial portion of cost early in the life cycle. The report notes that nowhere did Congress exclude the electric and gas utilities from the benefits which were to be conferred on American industry as a whole.

Tax Depreciation . . . The liberalized methods of tax depreciation are, according to the report, "any consistent methods of amortizing the cost of depreciable property whereby greater depreciation allowances are taken during the early years of the life of the property and lesser allowances during the later years."

The two principal methods provided for in the Revenue Bill of 1954 are: (1) the declining-balance method using a rate not exceeding twice the straight-line rate, and (2) sum of the years' digits method. Both methods are applicable only to property put in service after Jan. 1, 1954.

With respect to the declining-balance method, the Ebasco report states that it "provides for the calculation of annual depreciation by applying double the corresponding straight-line depreciation rate to the declining-balance, that is, cost less previously accumulated depreciation. This method provides double the straight-line allowances for the first year only, a progressively declining-allowance in subsequent years. Annual depreciation is equal to the straight-line rate when approximately one-third of estimated life has expired (depending on estimated life)."

"The foregoing declining-balance method of depreciation," the report continues, will accumulate depreciation equal to approximately 64% of the cost of the asset when one-half of the estimated life of the asset has expired (on assets with estimated service life in excess of 20 years). At the expiration of the estimated service life, 86 to 90% of the cost will be accumulated and this method will never fully depreciate the asset.

"It should be noted that both the House Committee on Ways and Means and the Senate Committee on Finance stated—'Only a taxpayer who maintains subsidiary depreciation records by year of acquisition, in addition to the group account, will have sufficient information to determine (1) the year in which the last survivor of a given years' acquisitions is retired and (2) the unrecovered cost of that year's acquisitions.'"

Adequacy of Property Records . . . "It is clear then that every utility should consider the adequacy of its property records before electing to compute tax depreciation under this method. The reason for this is that since property will never be fully depreciated at retirement there may be an unrecoverable loss for tax purposes where the records do not indicate the year of acquisition."

As to the sum of the years' digits method the Ebasco report states that it consists of the "application of varying rates of depreciation, which are progressively lower each year over the service life of the asset, to a constant balance in the property account reduced by estimated salvage. The rate for any year consists of a fraction, the numerator of which is the number of the years remaining in the estimated useful life including the current year and the denominator of which is the sum of the numbers representing the total number of years estimated service life.

"The sum of the years' digits method is somewhat more liberal than the declining-balance method, since, on long-lived property, it accumulates to nearly 75% in the first half of the estimated service life against 64% for the former method. It usually produces slightly less depreciation in the first year, but more in all subsequent years than the declining-balance method described in the code. It fully depreciates the asset at the end of its estimated service life."

The report develops certain equations whereby this method can be applied to groups of property with considerable accuracy.

Fast Methods of Tax Depreciation . . . In evaluating the comparative financial position of a utility using liberalized tax depreciation as compared with the straight-line method, the Ebasco report considers the effect on capitalization especially with regard to new common stock requirements over a period of years.

In dealing with the problems of the rate base and earnings, the report lays considerable stress on the fact that adverse regulatory action can completely negate the intent of Congress by allowing the temporary tax deferral to accrue to the customers of the utility. Such a condition would result if the regulatory commission ordered the utility to use actual and not normalized taxes in determining the cost of service, deducting total tax deferral from the rate base or requiring utility to "book" annual tax depreciation.

In countering the possible charge that the customers of the utility will be financing a portion of the company's expansion through their rates, the Ebasco report has this to say; "As far as the customer is concerned the rates that he will pay will be no greater under the accelerated methods available in the provisions of the Revenue Act of 1954 than under the conventional ones that have hitherto been available.

"This point is well expressed in the decision of the Federal Power Commission in the recent Panhandle case

when the order, in discussing liberalized amortization, stated: 'As we previously pointed out in Opinion No. 264, the customers of Panhandle will not be called upon by reason of the accelerated amortization provision to do anything different than what they would be called upon to do without that provision. **They will pay the same rates; no more, no less.** They neither lend nor give their money to Panhandle. It is the other two parties to the transaction who change their position—the United States Government and Panhandle. The United States Treasury will not receive, in the five-year period, money which it otherwise would have received, and Panhandle will have the money which Congress does not require it to pay to the Treasury during that period. Thereafter, Panhandle must start paying the money back to the Treasury. No contribution is made by the customers.' "

Conclusions . . . In its conclusions, the Ebasco report lays considerable stress not only on the factors of discrimination as between present and future customers if commissions disallow the tax deferral in determining the "cost of service" but also on the importance of the utility industry being able to compete efficiently in the money market with that segment of unregulated economy that will enjoy full benefits of liberalized tax depreciation.

SMUD's Electric Rates Reduced $524,400 a Year

Electric customers of Sacramento (Calif.) Municipal Utility District will receive an annual rate reduction of $524,400, effective Oct. 1, 1954. Royal Miller, SMUD board president, announced the lower rates will reflect the savings in power costs resulting from purchase of Central Valley Project power. SMUD commenced buying CVP power on July 1.

Savings in purchased power costs, Miller stated, will total about $700,000 annually during the first year of operation. Consumers will get about 75% of the $524,400, with balance reserved for increased operating costs.

Miller pointed out this is the District's third and largest major rate reduction since it commenced opera-

(*Continued on page* 160)

Today in Utility Finance

YIELDS (%)

Quality	Bonds			Preferred Stocks			Common Stocks		
	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
DATE									
July 15	**2.88**	**2.94**	**3.16**	**4.00**	**4.11**	**4.44**	**4.57**	**4.81**	**5.26**
July 8	2.88	2.94	3.16	4.02	4.12	4.45	4.64	4.93	5.39
END OF QTR.									
2nd 1954	2.90	2.96	3.19	4.03	4.14	4.52	4.72	5.04	5.45
1st 1954	2.82	2.87	3.14	3.88	4.09	4.42	4.83	5.19	5.42
4th 1953	3.07	3.12	3.34	4.17	4.32	4.62	5.07	5.57	5.51
3rd 1953	3.30	3.33	3.54	4.35	4.52	4.83	5.36	5.97	6.01

Data: Reis & Chandler, Inc.

EARNINGS

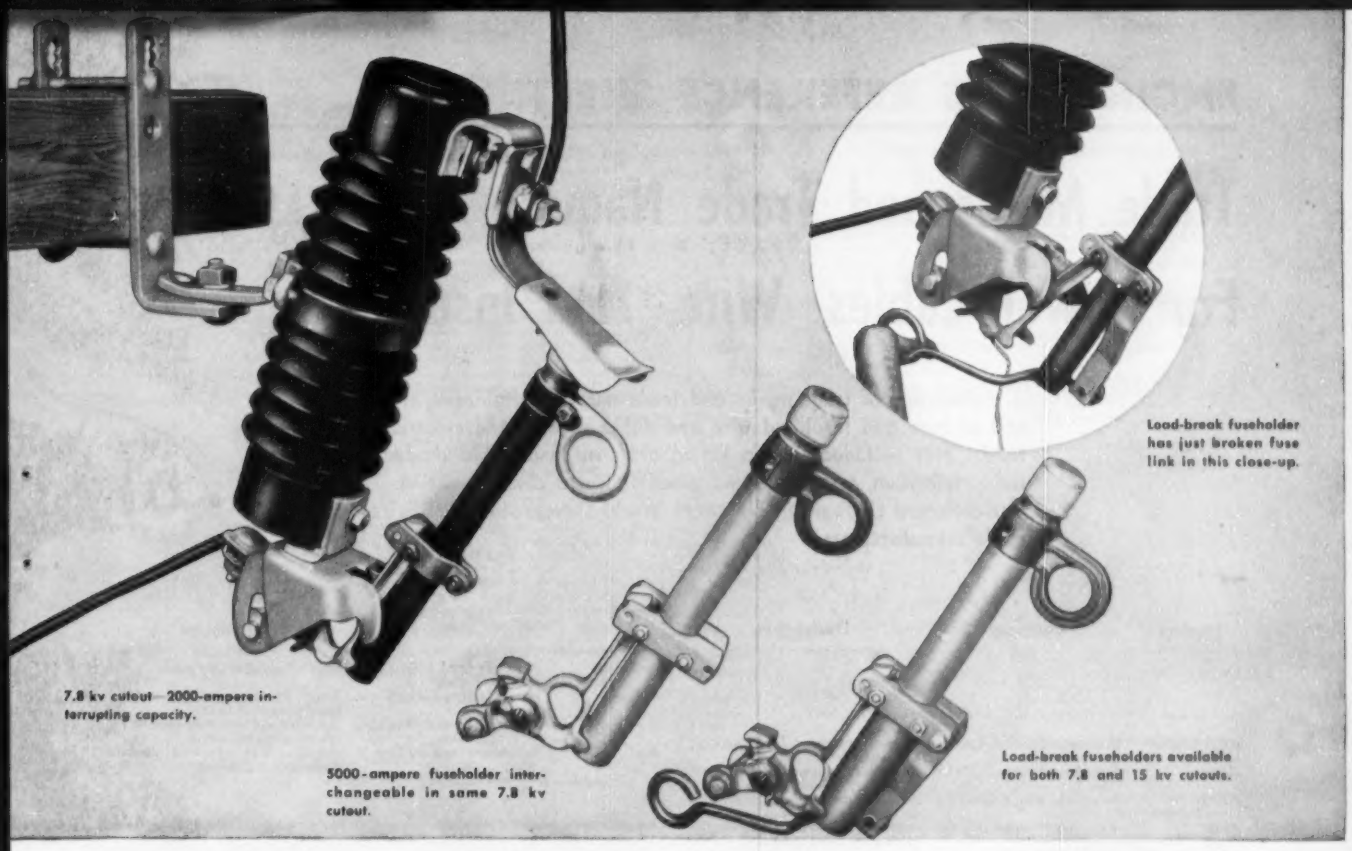
Company	Period Months Ended		Net Income 1953	Net Income 1952	Earnings Per Common Share 1953	Earnings Per Common Share 1952
Chicopee Electric Light Dept.	12	Dec.	$67,854(a)	$51,431(a)	$....	$....
City of Seattle, Dept. of Lighting	12	Dec.	6,238,873(b)	4,169,703(b)	....	....
Toronto Hydro-Electric System	12	Dec.	2,323,138(b)	.....	....	....

Notes— (a) Income balance transferred to profit and loss; and (b) Amount carried to surplus.

FINANCIAL

Company and Description	Amount of Offering (000)	Offering Price	Yield to Public
WEEK OF JULY 15-21			
Bonds			
Consolidated Gas, Electric Light & Power Co of Baltimore—1st mtg 3% due 1989	$40,000	100.65	2.97%
SCHEDULED FOR JULY—AUGUST—SEPTEMBER—OCTOBER			
Bonds			**Bid Date**
Boston Edison—1st mtg due 1984	$18,000	.....	July 26
Pacific Power & Light—1st mtg due 1984	30,000	.....	Aug. 9
Metropolitan Edison—1st mtg due 1984	3,000	.....	Aug. 15
Manitowoc, Wis.—electric revenues	1,250	.....	Aug. 16
Niagara Mohawk Power—1st mtg due 1984	25,000	.....	Aug. 24
Arkansas Power & Light—1st mtg due 1984	7,500	.....	Aug. 24
Southern California Edison—1st mtg	30,000	.....	Aug. 25
Indiana & Michigan Electric—1st mtg	16,500	.....	Oct. 5
Preferred Stock			
Southern Colorado Power—30,000 sh $50 par	1,500	.....	.....
Indiana & Michigan Electric—40,000 sh $100 par	$4,000	.....	Oct. 5
ISSUES RECENTLY POSTPONED			
Bonds			
Gulf States Utilities—1st mtg due 1984	$24,000	.....	.....
Consolidated Edison Co of N. Y.—1st mtg due 1984	50,000	.....	.....
Preferred Stock			
Missouri Public Service—50,000 sh $100 par	$5,000	.....	.....(a)
California Electric Power—105,000 sh $50 par	5,250	.....	.....(b)
Gulf States Utilities—160,000 sh $100 par	16,000	.....	.....
UNSCHEDULED, AND/OR UNDER CONSIDERATION			
Bonds and Debentures			
Long Island Lighting—1st mtg	$20,000	.....	.....
Kansas Power & Light—1st mtg	10,000	.....	.....
Central Hudson Gas & Electric—1st mtg	10,000	.....	.....
Connecticut Light & Power—1st mtg	10,000	.....	.....
Central Illinois Electric & Gas—1st mtg	4,000	.....	.....
New Orleans Public Service—1st mtg	6,000	.....	.....
Kentucky Utilities—1st mtg	15,000	.....	.....
Rockland Light & Power—debs due 1974	10,000	.....	.....(c)
Northern States Power—1st mtg	20,000	.....	.....
Montana-Dakota Utilities—1st mtg	12,000	.....	.....
Western Massachusetts Electric	6,000	.....	.....
Preferred Stock			
Rockland Light & Power	$4,000	.....	.....(c)
Northern States Power	20,000	.....	.....
Oklahoma Gas & Electric—75,000 sh $100 par	7,500	.....	.....
Central Hudson Gas & Electric—80,000 sh	.....	.....	.....
Common Stock			
New England Electric System—910,883 sh (to be offered common-holders on 1-for-10 basis)	.....	.....	.....
Kentucky Utilities—about 228,678 sh (to be offered common-holders on about 1-for-10 basis)	.....	.....	.....
Virginia Electric & Power—600,000 sh	.....	.....	.....

Notes—(a) Postponed indefinitely; Kidder, Peabody & Co. underwriters; (b) Temporarily postponed; Merrill Lynch, Pierce, Fenner & Beane group, underwriters; (c) To be sold privately.



7.8 kv cutout—2000-ampere interrupting capacity.

5000-ampere fuseholder interchangeable in same 7.8 kv cutout.

Load-break fuseholder has just broken fuse link in this close-up.

Load-break fuseholders available for both 7.8 and 15 kv cutouts.

NEW G-E OPEN DROPOUT CUTOUT

For FAULT PROTECTION—standard or heavy duty and LOAD BREAK—up to full load at any power-factor.

New simplified design of General Electric 7.8 kv and 15 kv, 100-ampere cutouts have these extra features:

Birdproof Construction accomplished by unique method of clamping the mounting support to the opposite side of insulator from live parts.

Liberal electrical and mechanical strength. New hollow tube wet process porcelain has under-cut petticoats for generous creep and strike distance; and porcelain insert fired within tube provides inside solid barrier between top and bottom live parts. Screen prevents insect nest within porcelain. Clamping U-bolt around porcelain is insulated with molded polyvinyl chloride having excellent insulating and weathering characteristics.

Compression bolting to porcelain—top and bottom fittings are bolted to insulator with porcelain under compression—for maximum mechanical strength. Compression clamps inside the porcelain maintain tight assembly.

Shielded top contact and latch—by roof-shaped contour and having ball-point contact surface to top of fuseholder, the top contact and its latch are protected from dirt deposits and sleet.

Other distinctive features are retained: Hinge guides allow slamming fuseholder from any angle; threaded cap seal at upper end of fuseholder forces expulsion gases downward; silver-plated contacts shielded from corrosive agents; vertical or angle-tilted swivel mounting with EEI-NEMA bracket; latch provides time-delay opening—assures fault current interruption before dropout action occurs; fuseholder tube of fiber and fabric-base Textolite* is water resistant, will not warp or split; close coupling of fuseholder to porcelain prevents multiplication of recoil forces.

For more information on these new open cutouts, contact your nearest G-E Sales Representative, or write to General Electric Company, Section 433-4, Schenectady 5, New York.

*Reg. trade-mark of General Electric Company

Progress is our most important product

GENERAL ELECTRIC

Trade Marks and Trade Names For Power Cables, Wire, And Insulation

A compilation of trade marks and trade names of insulating materials and of bare and insulated wire and cable used in the electric power field. Not included in the listing are wire and cable products for radio, television, telephone, and allied fields of communication. Data was collected through an Electrical World survey of over 60 wire and cable manufacturers.

Product	Company	Description
	A	
ACA Firewall	Rockbestos Products Corp	Synthetic tape and felted asbestos insulation
Accwire	Accurate Insulated Wire Corp	General trade names for cord types
ACR	Anaconda Wire & Cable Co	Heat, moisture and ozone resisting oil base compound
AHR	Anaconda Wire & Cable Co	Heat-resistant rubber insulation
AHT	" " " "	High-annealing copper
Alcoa EC	Aluminum Co of America	Electric conductor aluminum
Alectrel	General Cable Corp	Aluminum conductors
Alpha-Flex	Alpheduct Wire & Cable Co	Non-metallic sheathed cable
Amerine RW	American Steel & Wire Div, U. S. Steel Corp	Moisture resisting rubber compounds
" 35	" " " "	" " " "
" 40	" " " "	" " " "
" 60	" " " "	" " " "
Ambersheath	Rome Cable Corp	High-visibility yellow neoprene-jacketed mining cables
Amerbestos	American Steel & Wire Div, U. S. Steel Corp	Asbestos-insulated wire and cable
Amerbus	" " " "	Fibrous covered portable cable
Amercled	" " " "	Rubber or neoprene sheathed cords and cables (lead-vulcanized)
Amercord	" " " "	Neoprene-sheathed portable cord N.E.C. standard
Amerductor	" " " "	Rural distribution bare conductors
Amerfelt	" " " "	Felted type weatherproof wire
Amerglass	" " " "	Glass insulated wires and cables
Amergraph	" " " "	Oil field cords and cables
American	American Metal Moulding Co	Armored bushed cable
"	American Steel & Wire Div, U. S. Steel Corp	Braid covered mining cables, elevator cables, tree wire
Americore	" " " "	Code grade rubber-insulated building wire compound
Amerite	" " " "	Performance grade 30% rubber compound
Amerprene	" " " "	Neoprene sheath compound
Amerseal	" " " "	Non-metallic parkway cable, jute covered
Amersheath	" " " "	Non-metallic parkway cable, rubber or neoprene sheath
Amersteel	" " " "	All steel rural conductor
Amerstrand	" " " "	Galvanized steel strand
Amerzone	" " " "	Ozone and corona-resisting rubber compound
Ametallic	" " " "	Metallic parkway cables, Type RLJFJ
Amperox	" " " "	Type RH building wire, heat resistant rubber compound
Ampolene	" " " "	Polyethylene resin insulation
Ampyrol	" " " "	PVC insulation
AME	Aneconda Wire & Cable Co	Moisture-resistant rubber insulation
Amvar	American Steel & Wire Div, U. S. Steel Corp	Magnet wire, vinyl acetal insulation
Anacondaloy	Anaconda Wire & Cable Co	Lead alloy coating for copper wire
Anhydrex	Simplex Wire & Cable Co	Moisture resistant insulation
Anhydrex Underground	" " " "	Moisture resistant, neoprene jacketed, underground cable
Anhydrex XX	" " " "	Heat, moisture and ozone-resistant high-voltage insulation
Anhydroprene	" " " "	Neoprene sheathed cable for use in conduit and ducts
Anoroc	" " " "	Ozone-resisting insulation
Ankoseal	Ansonia Wire & Cable Co	Thermoplastic insulations and jackets
ANW	Anaconda Wire & Cable Co	Rubber and neoprene insulated network cable for duct use
AOR	" " " "	Oil-resistant rubber insulation
Aquanol	General Electric Co	Type RW building wire
Aquasun	Circle Wire & Cable Corp	Type RW building wire
Aquaseal	General Cable Corp	Moisture-resistant, low SIC insulation. Type RW submarine rubber insulation
Armorlokt	American Steel & Wire Div, U. S. Steel Corp	Interlocking steel tape armor
Armortite	Hazard Insulated Wire Works	Type RJ non-metallic armored underground cable
AV or AVC	American Steel & Wire Div, U. S. Steel Corp	Asbestos and varnished cambric insulated cords and cables
AVC	Rockbestos Products Corp	Asbestos and varnished cambric power and control cables
	B	
BAC	Ettco Wire & Cable Co	Bushed armored cable
Barkhide	General Cable Corp	Tree wire
Beldenamel	Belden Manufacturing Co	Enameled magnet wire
Besto Wire	Rhode Island Insulated Wire Co	Types A, AF, AA, AI, AIA, AVA, AVB, TA asbestos wires and cables; Type TW building wire; Type SPT portable cord; thermostat wires and cables
Bethanized	Bethlehem Steel Co	Galvanized steel wire and strand
B.I.W.	Boston Insulated Wire & Cable Co	Heavy duty cords and cable
BraidX	General Electric Co	Non-metallic sheathed cable
Bronco 40	Western Insulated Wire Co	Rubber-jacketed cords and cables Types S, SJ, and SV
" 60	" " " "	Neoprene-jacketed cords and cables Types SO, W, G, SJO, and SV
" Asbestos Insulated	" " " "	Wires and cables insulated with Chrysotile asbestos Types AF, AIA, AVA, and AVB
Butarone	General Cable Corp	Butyl insulation (corona resisting) compound for high-voltage power cables
BX	General Electric Co	Interlocking armored cable
	C	
Cablex	Collyer Insulated Wire Co	Non-metallic sheathed cable
Calsun Bronze	Anaconda Wire & Cable Co	Copper-tin-aluminum alloy line wire
Candee	The Okonite Co	Completely insulated weatherproof wire
Canvas Back Loom Wire	National Electric Products Corp	Non-metallic sheathed cables
Ceroprene	Carol Cable Co	Neoprene insulated flexible cords
CB	Anaconda Wire & Cable Co	Carbon black type paper-lead cable
CB-OT	The Okonite Co	Light-weight corrugated bronze tape finish with neoprene overall which serves as a protective covering for direct burial
Celenamel	Belden Manufacturing Co	Enamel and cellophane magnet wire
Center-Red	American Insulated Wire Corp	POSJ portable cord
Circab	Circle Wire & Cable Corp	Neoprene barn cable
Circlemold	" " " "	Heavy duty cords and cables
Circleprene	" " " "	Neoprene-sheathed cables
Circlesheath	" " " "	Neoprene non-metallic parkway cable
Circle-Super	" " " "	Type RH building wire
Circle-Weatherprene	" " " "	Neoprene insulated weatherproof wire

Electric Power Cable Trade Names

Product	Company	Description
Cirflex	Circle Wire & Cable Corp	Non-metallic sheath cable, Type R insulation
Cirtex	" " " "	Non-metallic sheath cable, Type T insulation
Clift-X	Clifton Conduit Co	Non-metallic sheathed cable
Coldcote	Anaconda Wire & Cable Co	Weatherproof sealing compound
Columbia-Flex	Columbia Cable & Elec Corp	Non-metallic sheathed cable
Columbia-UF	" " " "	Underground feeder and branch circuit cable
Compack	General Cable Corp	Compacted stranded conductor
Condex	Simplex Wire & Cable Co	Metallic interlocking armored parkway cable
Copperweld-Copper Conductors	Copperweld Steel Co	Copper-covered steel wires and copper wires, stranded into power conductors
Copperweld Strand	" " "	Strands of copper-covered steel wires, overhead ground wires, guy and messenger strand
Copperweld Solid Wire	" " "	Copper-cover steel wire
Coprsheath	Anaconda Wire & Cable Co	Underground paper-insulated cable with copper sheath
CordX	General Electric Co	All-rubber cords
CordX Jr.	" " "	Insulated electric cord
Coronol	" " "	Electrical wires, cables, and conductors; particularly ozone resisting insulated wire and cable
Corwico	Cornish Wire Co	Electrical wires
Cotenamel	Belden Manufacturing Co	Enamel and cotton magnet wire
Cottonite	Acme Wire Co	Enamel and cotton magnet wire
Crapo	Indiana Steel & Wire Co	Galvanized and stainless steel strand, steel conductor, and cable lashing wire
Crescord	Crescent Insulated Wire & Cable Co	All-rubber cords and cables
Cresflex	" " "	Non-metallic sheathed cable

D

DD Duraseal	Anaconda Wire & Cable Co	Non-metallic parkway cable
Deltabeston	General Electric Co	Asbestos-covered insulated wire and cable
Deltaglass	" " "	Glass-insulated magnet wire
Densheath	Anaconda Wire & Cable Co	Flame retarding all purpose PVC insulation or jacket, 600 v
Dilec	National Electric Products Corp	R. C. building wire with cotton wrap in place of braid
Dilex-Safecote	John A. Roebling's Sons Corp	Building wire; cotton wrap in place of braid
Dipsol	Wheeler Insulated Wire Co	Liquid nylon magnet wire
Dreadnaught	Paranite Wire & Cable Div, Essex Wire Corp	Heavy-duty neoprene and rubber-sheathed portable cords and cables
Dualay	The Okonite Co	Periodic reversal of conductor lay in multi-conductor assembly to permit tapping without cutting conductor
Duracode	Anaconda Wire & Cable Co	Heat and moisture resistant industrial cable
Duracord	" " " "	Loom-covered portable conductors, cables, and tree wire
Duraline	" " " "	Weatherproof O/H line wire; fibrous Type URC covering
Durall and Durall-T	" " " "	Neoprene, barn type, non-metallic sheathed cable for moist locations
Durapower	Carol Cable Co	Welding cable
Duraprene	Anaconda Wire & Cable Co	All-rubber insulated building wire, 600 v
Durasheath	" " " "	Neoprene jacket compound
"	" " " "	Type RW insulation, neoprene jacketed
"	" " " "	All-rubber cable for aerial, duct, or buried use
Durax	" " " "	Rubber-insulated, non-metallic sheathed cable
Dutrax	" " " "	Non-metallic sheathed cable with Densheath insulation
Dynaprene	Whitney Blake Co	Neoprene-jacketed flexible cords

E

Empire	Empire Wires & Cables	Armored cable, non-metallic cable, and RR and TW wires
Enamelite	Acme Wire Co	Enameled magnet wire
Endurite	Crescent Insulated Wire & Cable Co	Type RH building wire
Enterite	General Cable Corp	Service drop cable
Eonite	U. S. Rubber Co	Heat-resistant rubber insulation
Ettcoflex	Ettco Wire & Cable Corp	Non-metallic sheathed cable
Ettco Plastic	" " " "	Type TW building wire
Everdur	Anaconda Wire & Cable Co	Copper-silicon-manganese alloy

F

F3	Anaconda Wire & Cable Co	Special alloy lead sheath
Fibrex	Simplex Wire & Cable Co	Non-metallic taped tree wire, drop wire, alarm cable
Firefite	American Steel & Wire Div, U. S. Steel Corp	Building wire; flame-retarding and moisture-resisting finish
Firestop	National Electric Products Corp	MRFR finish for building wire
Flamenol	General Electric Co	Thermoplastic polyvinyl insulated wire and cable
Flame Stop	Habirshaw Cable & Wire Div, Phelps Dodge Copper Prod Corp	Rubber covered building wire
Flexlay	National Electric Products Corp	Full metallic and non-metallic armored parkway cables
Formbond	Acme Wire Co	Thermoplastic resin over "Formvar wire"
Formex	General Electric Co	Vinyl acetal insulated magnet wire

G

Gencalloy-A	General Cable Corp	Arsenical lead alloy
Gencaseal	" " "	Thermoplastic polyvinyl types insulation and jackets
Gencorone	" " "	Ozone-resistant insulation
Glasterra No. 407	Kennecott Wire & Cable Co	Regular varnish bonded magnet wire
Glasterra No. 507	" " " "	Silicone varnish bonded magnet wire
Glazon	Triangle Conduit & Cable Co	Types R, RP, and RH-RW building wire
Glazon Thermo-Triex	" " " "	Non-metallic sheathed cable with TW insulation on individual conductors
Glazon Triex	" " " "	Non-metallic sheathed cable
Glyptal	General Electric Co	Insulating and protective resin-base varnishes
Granite	U. S. Rubber Co	Service entrance and service drop cables, Type SE & SD wire
Grizzly	" " "	Non-metallic jacketed cable
Guardian	General Cable Corp	Building wires and cables, Type R, RH, RW, T, TW, V. C.

H

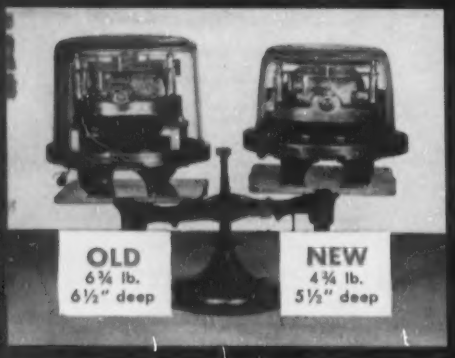
Habir-Bus	Habirshaw Cable & Wire Div, Phelps Dodge Copper Products Corp	Special construction for bus duc system of power distribution
Habirduct	" " "	Heat and moisture resisting insulation, Type RH-RW
Habirdure	" " "	Thermoplastic PVC insulation and sheath
Habirite	" " "	Butyl rubber ozone resisting Insulation
Habirlene	" " "	Polyethylene insulation and sheaths
Habirloy	" " "	Alloy lead sheaths
Habirprene	" " "	Neoprene insulation and sheaths
Habirshaw	" " "	All kinds of insulated wires and cables
Hatex	Hatfield Wire & Cable Co	Non-metallic sheathed cable
Hazacord	Hazard Insulated Wire Works	Mold-cured neoprene-jacketed portable cords and cables
Hazakrome	" " " "	Thermoplastic insulated wires and cable sheath
Hazalatex L	" " " "	Natural rubber latex insulation
Hazalatex N	" " " "	Composite wall of natural rubber latex insulation and protective neoprene latex
Hazalene	" " " "	Low-loss thermoplastic polyethylene insulation and sheath
Hazaprene	" " " "	Flame-resisting neoprene jacket
Hazaprene Latex	" " " "	Neoprene-latex wall applied as protection over natural rubber Hazalatex L
Hazasheath	" " " "	Neoprene-jacketed non-metallic underground cable
Heatex	The Acme Wire Co	Glass fibre insulated magnet wire
Hex-Tite	Hazard Insulated Wire Works	Hexagonal shaped conductors that prevent twisting of conductors in portable cables
Hi-Temp	Rockbestos Products Co	High temperature asbestos-insulated wires and cables
Hitenso A	Anaconda Wire & Cable Co	Copper-cadmium alloy
Hitenso BB	" " " "	Copper-cadmium alloy
Hitenso C	" " " "	Copper-tin-cadmium alloy
HO	Habirshaw Cable & Wire Div, Phelps Dodge Copper Products Corp	High pressure oil-filled pipe type cable
Hudco	Hudson Wire Co	Copper wire

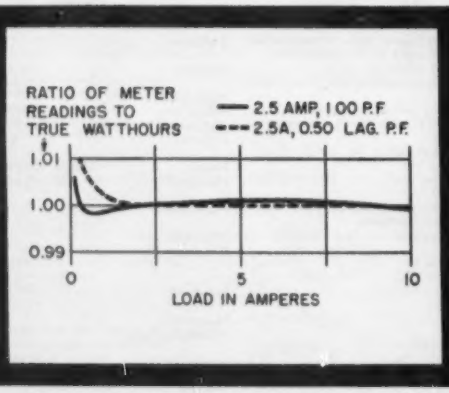
Another new member of the I-50 family

5 REASONS WHY THIS

NEW G-E 2½-AMP METER*

WILL LOWER YOUR METERING COSTS





1 **NEW TRANSFORMER-RATED METER** is lighter, smaller than older types; means faster, easier installation, lower handling costs.

2 **STRAIGHT-LINE ACCURACY** over 400 per cent load range combines accuracy and transformer flexibility; gives accurate use over wide load range.

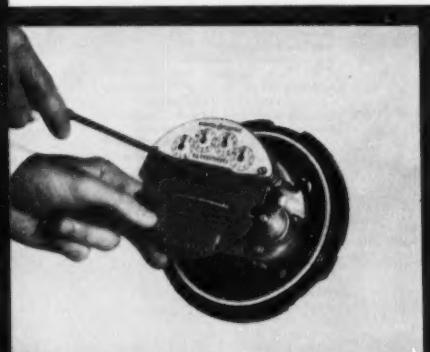
3 **MAGNETIC SUSPENSION,** with "floating disc," provides extreme accuracy and stability of calibration; minimizes testing and maintenance costs.

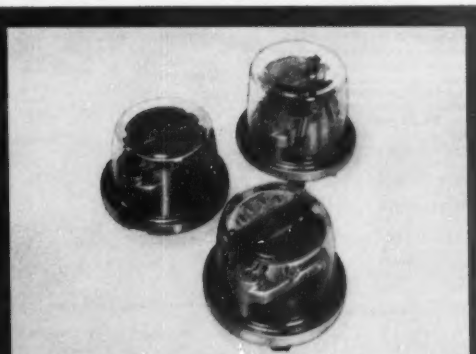
* **FOR MORE INFORMATION** on the new General Electric 2½-ampere I-50 transformer-rated watthour meter, or for a sample demonstration, contact your nearest G-E apparatus representative or write Section 601-105, General Electric Co., Schenectady 5, New York.

NEW

General Electric Type I-50 2½-ampere transformer-rated watthour meter

LATEST ADDITION to the General Electric I-50 family, the 2 1/2-ampere transformer-rated meter is designed for use with current and potential transformers. When used with the proper transformer, the new meter has the inherent accuracy of the I-50 family.





4 **DETACHABLE NAME PLATE** allows easy rating for any transformer ratio, increases flexibility, facilitates re-rating as future load grows.

5 **ATTRACTIVE DESIGN** of dependable new 2½-amp meter gives nicety of appearance consistent with other members of the I-50 family; combines versatility with appearance.

GENERAL ELECTRIC

Electric Power Cable Trade Names

Product	Company	Description
Hydro-Therm	Paranite Wire & Cable Div, Essex Wire Corp	Moisture and heat resistant rubber insulation
Hydrosec-S	U. S. Rubber Co	Heat and moisture resistant, low SIC, synthetic rubber insulation
Hyfilm	Acme Wire Co	Thin high-dielectric varnished cambric
Hy-Therm	Anaconda Wire & Cable Co	High-annealing-temperature copper wire
Hyvolt	Crescent Insulated Wire & Cable Co	Heat, moisture and ozone-resistant high-voltage insulation
I		
Imperial	Crescent Insulated Wire & Cable Co	Neoprene-jacketed portable cables
Imperial Crescord	" " "	Neoprene-jacketed cords
Impervex	" " "	Type RW building wire
Impervex Trenchcable	" " "	Non-metallic parkway cable
Ince	Phelps-Dodge Copper Products Corp	Magnet wire
Indestructo	National Electric Products Corp	Neoprene-jacketed cords and cable
Insoluseal	Anaconda Wire & Cable Co	High voltage pothead filling compound
Ironite	" " " "	R. C. iron telephone and tree wire
IXL	Collyer Insulated Wire Co	Rubber-insulated wire
K		
Kenline	Kennecott Wire & Cable Co	Line of overhead conductor
Kenrite	American Insulated Wire Corp	Asbestos-covered cords
Kerite	The Kerite Co	Special electrical insulation
Keystone	Hazard Insulated Wire Works	Heat, moisture and ozone-resistant insulation
Keystone-Hazaprene	" " " "	Heat, moisture and ozone-resistant insulation with bonded neoprene sheath
K/W	Kaiser Aluminum & Chemical Corp	Bare and covered aluminum conductors
L		
Laytex	U. S. Rubber Co	90% unmilled natural rubber insulation
Line-Tap	The Okonite Co	Self-supporting aerial cable that can be tapped hot
Loomwire	National Elec. Products Corp	Non-metallic sheathed cable
Loxarmor	The Okonite Co	Interlocking galvanized steel armor
Loxbronze (Parkway)	Hazard Insulated Wire Works	Type RLJIJ with interlocking bronze armor
Loxsteel (Parkway)	" " " "	Type RLJIJ underground cable with interlocking steel armor
Loxzinc (Parkway)	" " " "	Type RLJIJ with interlocking zinc armor
M		
Moistemp	Rockbestos Products Co	Asbestos-insulated wires and cables
N		
Nada	Copperweld Steel Co	Bronze wire
Narax	Narragansett Wire Co	Non-metallic sheathed cable
Narawire	" " "	Type R-RR-RH-RHW-RL, T or TW building wire
NEasbestus	National Electric Products Corp	Asbestos V. C. wires and cables
Neolay	U. S. Rubber Co	Nylon covered laytex building wire
Neoline	Anaconda Wire & Cable Co	Neoprene-covered weatherproof overhead line wire
Nepconol	National Elec. Products Corp	Type T or TW building wire, machine tool wire, Type UF wire and any construction employing thermoplastic compound
NE-O-Prene	" " " "	Neoprene insulated and jacketed, non-metallic sheathed cable for moist locations
NE-O-Prene	" " " "	Neoprene-jacketed service entrance cable
Neoproof	American Steel & Wire Div, U. S. Steel Corp	Neoprene-coated line wire
Neotherm	National Elec. Products Corp	Type RH building wire
Nepcoblend	" " " "	Insulation composed of a blend of thermoplastic and Buna-N
Nepco-Lok	" " " "	Interlocked armored power cable
Nepcoseal	" " " "	Type RW building wire
Nepcozone	" " " "	Heat, moisture, and ozone resistant oil base or butyl base insulation
Nutun	U. S. Rubber Co	GR-S unmilled rubber insulation
Nylclad	Belden Manufacturing Co	Class A film coated
Nyltexenamel	" "	Textile covered enamel wire
Nyvar	The Acme Wire Co	Composite coating of nylon and Formvar
O		
Oakex	Acorn Insulated Wire Co	Non-metallic sheathed cable
Oilostatic	The Okonite Co	Paper-insulated cable operated in welded steel pipe line filled with oil under high pressure
OilX	General Electric Co	All-rubber cords
OilX Jr.	" " "	All-rubber cords
OK	General Cable Corp	Double or triple-braid URC weather proof wires and cables
Okite	Acorn Insulated Wire Co	Type T or TW building wire
Okobestoprene	The Okonite Co	Non-flammable asbestos-base tape for cable assemblies
Okobestos	" " "	Heat and flame-resistant asbestos insulation
Okocel	" " "	Paper-insulated cable
Okocord	" " "	Portable cords and cables with rubber or Okoprene sheaths
Okoglass	" " "	Non-combustible and heat-resistant glass insulated wire and cable
Okoground	" " "	Insulated flexible cable for temporary grounding of overhead lines
Okojute	" " "	Non-metal, jute-protected track wire
Okolest	" " "	Tree wire with brake lining armor and braid covering treated for high abrasion resistance
Okolene	" " "	Low loss thermoplastic polyethylene-base insulation
Okolite	" " "	Moisture heat and corona resistant oil-base rubber insulation.
Okolite-Okoprene	" " "	Moisture, heat, and corona resistant insulation with Okoprene jacket
Okoloom	" " "	Tree wire or other wire with heavy fire-hose loom woven braid
Okoloy	" " "	Corrosion-resistant lead alloy coating for copper conductor
Okometal	" " "	Special lead sheath alloy for paper insulated cables
Okonite	" " "	30% Mineral-base rubber insulation
Okoprene	" " "	Oil, heat, ozone, and weather-resistant sheath made with neoprene
Okoseal	" " "	Thermoplastic PVC insulation
Okosheath	" " "	Moisture-resistant rubber compound serving as insulation and sheath
Okosheath Protect Covering	" " "	A vulcanized covering of reinforced Okoprene used over lead sheaths to eliminate corrosion
Okotherm	" " "	Silicone heat-resistant rubber insulation
Okover	" " "	Varnished cambric insulation
O. N. C.	General Electric Co	Asbestos-insulated cable
Ovalflex ABC	National Elec. Products Corp	Flat twin ABC armored cable
P		
Paperite	The Acme Wire Co	Enamel and paper magnet wire
Parecore	U. S. Rubber Co	Rubber insulated building wire
Paragon	General Electric Co	Insulating tape
Paragon Ironite	Paragon Electric Co	Iron conductor, rubber-braid URC finish
Paragon URC Braid	" " "	Iron conductor, rubber-braid URC finish
Paraprene	Paranite Wire & Cable Div, Essex Wire Corp	Oil, heat, ozone and weather resistant sheath made with neoprene
Paresyn	" " " "	Plastic insulated wire, T or TW
Paratherm	" " " "	Type RH rubber-covered wire

Electric Power Cable Trade Names

Product	Company	Description
Paratwin	Essex Wire Corp	POSJ cord
Parause Type RR	" " " "	Underground service entrance cables
Parkerite	Seward	R. C. building wire
PD-X	Habirshaw Cable & Wire Div, Phelps Dodge Copper Products Corp	Non-metallic sheathed cable, Type NM
PDX-N	" " "	Non-metallic sheathed cable, Type NMC, neoprene barn wire
Peerless	General Cable Corp	Cotton-felted and cotton covered URC weatherproof wire and cable
Peerless SD	" " "	Peerless type service drop cable
Performite	Hazard Insulated Wire Works	Heat resisting insulation, also used on Type RH building wire
Permacord	Crescent Insulated Wire & Cable Co	Heavy-duty portable cords and cables
Perma-Dure	Habirshaw Cable & Wire Div, Phelps Dodge Copper Products Corp	Non-metallic sheathed cable, Type NMC, and underground feeder Type UF
Phalo Cord	Phalo Plastics Corp	Thermoplastic insulated power supply cords
Phalon	" " "	Thermoplastic insulated wire
Phalo-X	" " "	Thermoplastic insulated and jacketed power supply cables
PIW-Easy Slip	Philadelphia Insulated Wire Co	POSJ portable cord
Plastex	Simplex Wire & Cable Co	Thermoplastic insulation type PVC applied to wire, busduct, types UF and MNC underground feeder cable, and series street lighting cable
Plasticon	Plastic Wire & Cable Corp	Type T or TW building wire
Plasticord	Chester Cable Corp	Portable cords, flexible cords
Plasticore	" " "	Polyvinyl primary insulation with braided outer covering
Plasticote	" " "	Type TW and Type UF non-metallic sheath cable
Plastiseal	Anaconda Wire & Cable Co	Plastic-encased magnet wire coil
Plastite	Whitney Blake Co	Synthetic resin insulation
PNA	American Steel & Wire Div, U. S. Steel Corp	Polyethylene, nylon, ampyrol multi-conductor control cable
PNR	Rockbestos Products Corp	Multi-conductor control cable
Polene	Anaconda Wire & Cable Co	Overhead line wire, polyethylene weatherproof covering
Polyclad	Chester Cable Corp	Polyethylene insulated weather-proof wires
Powerduct	Anaconda Wire & Cable Co	Loom construction for bus duct system of power distribution
PreenX	General Electric Co	Heat-resistant cords
P. S. Shielding	American Steel & Wire Div, U. S. Steel Corp	Conducting rubber shielding tape
PVC	Plastic Wire & Cable Corp	Thermoplastic polyvinylchloride
PVX	General Electric Co	Non-metallic sheathed cable, especially with polyvinyl insulation
Pyrosec-S	U. S. Rubber Co	Heat and moisture resistant synthetic rubber insulation

Q

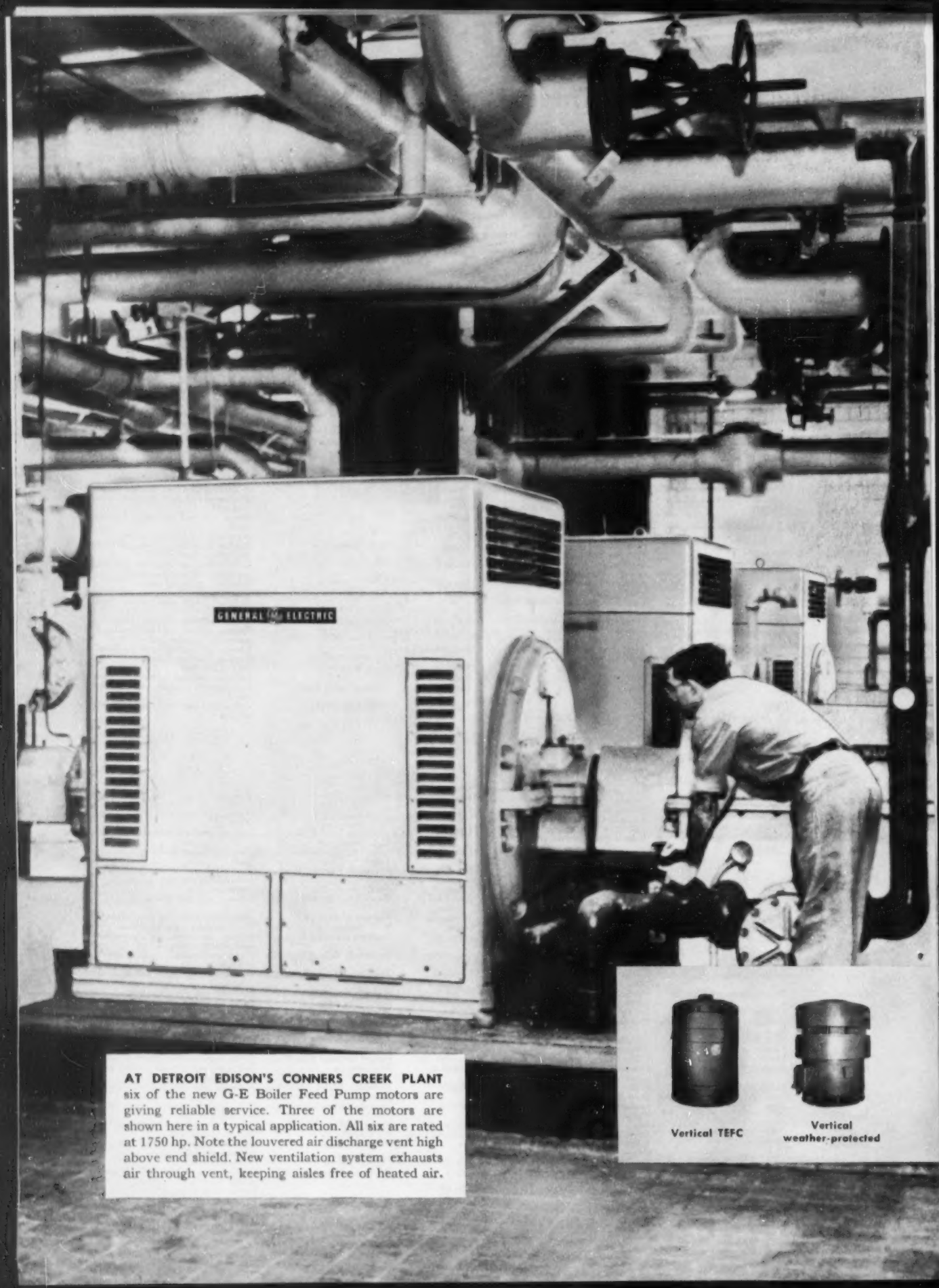
Q-D, Type 1	Kennecott Wire & Cable Co	Single Quinterra and single Dacron bonded magnet wire
Q-M, Type 1	" " " "	Double Quinterra and Mylar 0.0065 in. magnet wire
Q-M, Type 2	" " " "	Single Quinterra and Mylar 0.0035 in. magnet wire
Quaridge	Boston Insulated Wire & Cable Co	Rubber sheathed cord and cable

R

Radix	Radix Wire Co	Asbestos and thermoplastic-insulated wire
Rancho	Western Insulated Wire Co	Rubber jacketed portable cords utility grade Types S and SJ
Raylock	General Electric Co	Building wire
Reliance	American Steel & Wire Div, U. S. Steel Corp	Weatherproof and slowburning wires
Relio	U. S. Rubber Co	Performance rubber insulation
Resistol	Collyer Insulated Wire Co	Thermoplastic PVC
Rip-Flex	Hatfield Wire & Cable Co	POSJ portable cords
RoBarn	Rome Cable Corp	Non-metallic sheathed cable, neoprene barn type
Rockbestos AVC	Rockbestos Products Corp	ASB—VC—ASB
Roebling	John A. Roebling's Sons Corp	Braid finish on building wire, flame resistant
Roebond	" " "	Plastic plus bond coat on magnet wire
Roebx	" " "	Non-metallic sheathed cable
Roecable	" " "	Neoprene-jacketed, jute-filled portable cables
Roeclad	" " "	Same as Roecable with rubber filler
Roecord	" " "	Heavy-duty cords and cables, rubber sheathed
Roecozone	" " "	Oil-base, ozone-resisting, synthetic rubber insulation
Roeglas	" " "	Glass-insulated magnet wire
Roeplastic	John A. Roebling's Sons Corp	Thermoplastic polyvinyl insulation
Roeprene	" " "	Neoprene-jacketed mining machine cables
Roesheath	" " "	30% rubber insulated, 60% rubber-jacketed underground cables
Roetemp	" " "	Magnet wire with heat-resistant insulation for Class B applications
Roevar	" " "	Vinyl acetal magnet wire
Roeweld	" " "	60% rubber jacketed welding cable
RoFlex	Rome Cable Corp	Non-metallic sheathed cable Type NM
Rollcord	John A. Roebling's Sons Corp	Neoprene-jacketed heavy duty Type SO and SJO
RoLene	Rome Cable Corp	Polyethylene-thermoplastic insulation or sheath
RoLon	" " "	Nylon insulation or sheath
RoMarine	" " "	Type RW-RH rubber insulation
RoMarine-RoPrene	" " "	Type RW-RH rubber-insulated, neoprene-sheathed power cable; Type USE, Style RR
Rome Aluminum	" " "	Aluminum cables
Rome Amber-sheath	" " "	High-visibility yellow neoprene-jacketed mining cable
Rome Dual-Purpose	" " "	Type RW-RH building wires
Rome FlexAll	" " "	Non-metallic sheathed cable Type UF and Type NMC
Rome Synthinol	" " "	Polyvinylchloride thermoplastic insulation and sheath
Romex-N	General Cable Corp	Neoprene type non-metallic sheathed cable (barn wire)
RomexUF	" " "	Multi-conductor underground feeder and branch feeder cable
Rome 40	Rome Cable Corp	Rubber-jacketed portable cord
Rome 50	" " "	Neoprene sheathed flexible cord
Rome 60	" " "	Neoprene-jacketed portable cord and cable
RoNeon	" " "	Neon sign and oil-burner ignition cable
RoPrene	" " "	Neoprene insulation or sheath
Royal	U. S. Rubber Co	Rubber or neoprene jacketed cords and cables (lead cured)
Royal Gold	" " "	Gold rubber or neoprene jacketed cords and cables (lead cured)
Royalite	" " "	Neoprene jacketed cable
Royal Master	" " "	Latex-insulated rubber or neoprene jacketed cords and cables (lead cured)
RoZone	Rome Cable Corp	Ozone-resistant oil-base insulation
RoZone-RoPrene	" " "	Ozone-resistant oil-base insulated, neoprene jacketed cable
RoZone-RoSeal	" " "	Ozone-resistant oil-base insulated, Synthinol jacketed cable
Rubcord	U. S. Rubber Co	HSJ heater cord
Rubsec	" " "	Moisture-resistant rubber insulation
Ruralay	General Cable Corp	Non-metallic rural underground cable
Ruralductor	Bethlehem Steel Co	Galvanized steel wire for rural transmission

S

S (Suffix)	American Steel & Wire Div, U. S. Steel Corp	Indicates synthetic rubber compound
Safecote	John A. Roebling's Sons Corp	General line of building wire and cable
Safecote	National Electric Products Corp	Braid finish on building wire, flame and moisture-resistant
Safesteel	M. B. Austin Co	Armored cable
Safety MI wiring	General Cable Corp	Mineral insulated wiring
Salamender	General Electric Co	Asbestos-insulated wire and cable
Satina	U. S. Rubber Co	Finish for rubber jacketed cords
Seco	Southern Electrical Corp	Triplex neoprene self-supporting service drop cables, Al and Cu
Securityflex	Anaconda Wire & Cable Co	Neoprene-sheathed portable cords and cables
Semicon	The Okonite Co	A semi-conducting treated tape or compound
Shield Brand	Ansonia Wire & Cable Co	Weatherproof wire and cable
Siamese	Essex Wire Corp	POSJ portable cord
Silicote	Wheeler Insulated Wire Co	Silicone coated magnet wire
Silkenamel	Belden Manufacturing Co	Enamel and silk magnet wire
Silkenite	Acme Wire Co	Enamel and silk magnet wire
Silotex	Anaconda Wire & Cable Co	Silicone-glass magnet wire
Simcore	Simplex Wire & Cable Co	Type R building wire
Sno-Flex	Hazard Insulated Wire Works	White, non-metallic sheathed cable
Southwire	Southwire Co	Bare and weatherproof copper and aluminum conductor
Spiralok	American Metal Moulding Co	Watertite, interlocked metallic armor
Spiralon	Surprenant Manufacturing Co	PVC insulation—spiral tracer strip with nylon jacket
Spiralweave	Hazard Insulated Wire Works	Fire-hose type loom-woven braid
Stabilized Lead	The Okonite Co	Sodium-treated lead
Star	Acme Wire Co	Impregnating and molding coil and component compound
Strip-X	General Electric Co	All-rubber cord
Style C	Anaconda Wire & Cable Co	Service drop cable, 2/C Underwriters' Type S. D.
Style CF	" " " "	Service drop cable, 3/C
Style SC	" " " "	Service entrance cable, 2/C Underwriters' Type SE



AT DETROIT EDISON'S CONNERS CREEK PLANT six of the new G-E Boiler Feed Pump motors are giving reliable service. Three of the motors are shown here in a typical application. All six are rated at 1750 hp. Note the louvered air discharge vent high above end shield. New ventilation system exhausts air through vent, keeping aisles free of heated air.

Vertical TEFC

Vertical weather-protected

General Electric Boiler Feed Pump Motor Features Unique Ventilation System

Well-integrated bearing design means longer motor life

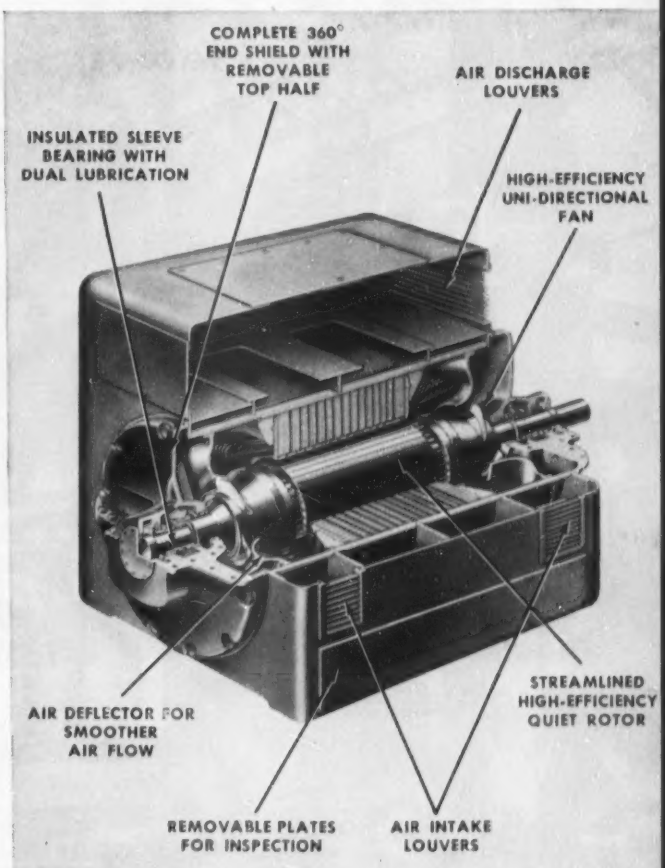
General Electric's Boiler Feed Pump motor, field proved in power stations across the country, has a revolutionary ventilation system which helps prevent recirculation of heated discharge air. Air, drawn in through the sides of the motor, is discharged high over the pump and away from aisles and employees. This means motors can be mounted closer together and still get proper ventilation.

QUIET OPERATION is assured because the G-E Boiler Feed Pump motor is designed for minimum inherent noise. In addition, these motors can be modified to meet specific sound level requirements.

LONGER BEARING LIFE means motors last longer, and the bearing system of G-E Boiler Feed Pump motors is designed for the reliable year 'round operation so vital to your industry.

- Dual lubrication system, both ring and force-flood, assures thorough lubrication and cool bearing oil.
- Amply proportioned bearings provide even distribution of stress. Bearings are insulated to prevent circulation of shaft currents.
- Soft-metal labyrinth seals are carefully machined to keep dirt out, oil in.

WHATEVER YOUR NEEDS in power station motors, General Electric can furnish a complete line—a wide variety of designs and enclosures to meet every operating condition. For more information on G.E.'s Boiler Feed Pump motor (Bulletin GEA-5813) or any of the complete line of power station motors consult your nearest Apparatus Sales Office, or write General Electric Company, Section 830-11, Schenectady 5, N.Y.


COMPLETE 360° END SHIELD WITH REMOVABLE TOP HALF
AIR DISCHARGE LOUVERS
INSULATED SLEEVE BEARING WITH DUAL LUBRICATION
HIGH-EFFICIENCY UNI-DIRECTIONAL FAN
STREAMLINED HIGH-EFFICIENCY QUIET ROTOR
AIR DEFLECTOR FOR SMOOTHER AIR FLOW
REMOVABLE PLATES FOR INSPECTION
AIR INTAKE LOUVERS

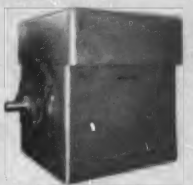
CUTAWAY OF NEW G-E BOILER FEED PUMP MOTOR

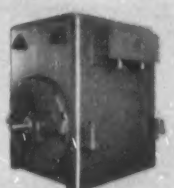
A COMPLETE LINE OF MOTORS FOR POWER STATION SERVICE

Totally-enclosed fan-cooled

Open drippproof

Grade-mounted weather-protected


Base-ventilated weather-protected

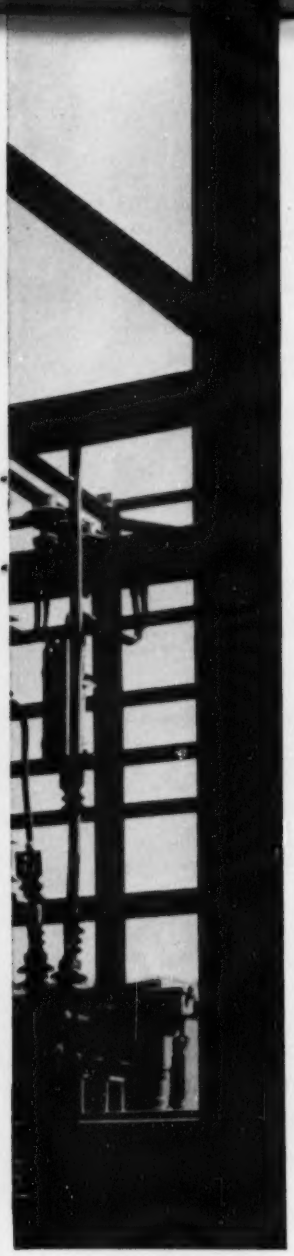

Totally-enclosed air-water cooled

Boiler feed pump

GENERAL ELECTRIC

SHIPPED AS A UNIT

G-E Stack-Racks include rigid rack with mounting pads, provision for insulator supports, mounted and wired capacitors, individual indicating fuses.



G-E Stack-Rack Capacitor Equipment Cuts Installed Costs

Permits "building block" capacitor banks of many kvar and voltage ratings, reduces installation time and costs, is easy to move or add to

High-voltage capacitor banks need no longer be field-assembled single-structure installations. With General Electric's new factory-assembled Stack-Rack capacitor equipment you can install capacitor banks in a wide range of kvar and voltage ratings, faster, at a lower installation cost, and with the flexibility you need to meet load growth and shifts in demand for bulk kilovars.

UP TO 600 KVAR BUILDING BLOCKS. Each single-phase G-E Stack-Rack is a complete unit that includes: (1) a strong, rigid, galvanized steel rack; (2) 10 to 24 units rated 25 kvar, from 2400 to 7950 volts; (3) an all-copper path for both line and neutral bus; (4) indicating, expulsion-type, bus supported fuses for each capacitor; (5) thick, welded mounting pads for stacking racks up to four high; (6) high-strength insulators for base and, when needed, between rack supports; (7) four lifting lugs welded to main supporting channels for hook or cable slings.

BANKS UP TO 330 KV. Open-type Stack-Rack capacitor banks can be supplied for any system voltage 2400 volts and above. Their primary application is on transmission and subtransmission circuits where they minimize installation time and cost. In addition, they have the advantage of permitting assembly on irregular plots and need no provision for fan power. These same advantages are provided for circuits below 15 kv when Stack-Racks are used in place of enclosed equipment.

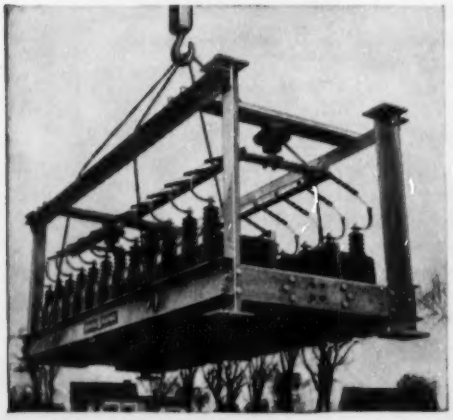
We believe it will pay you to evaluate your present practice on kilovar supply to take advantage of the economy and flexibility of the new G-E Stack-Rack. For complete information see your General Electric Apparatus Sales representative. General Electric Company, Schenectady 5, New York. 441-10

Progress is our most important product

GENERAL ELECTRIC

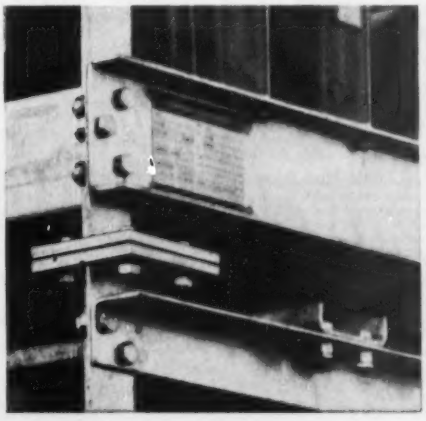
EASY TO HANDLE

Four lifting lugs welded to main supporting channels take either hook or cable slings—units remain in positive alignment.



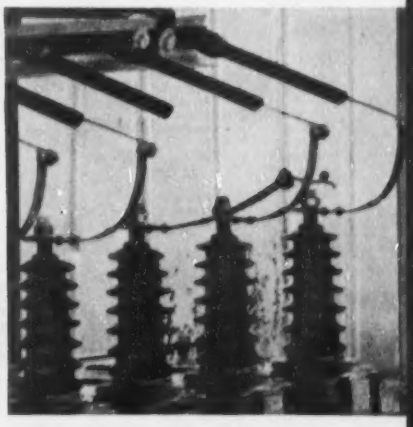
EASY TO INSTALL

Thick welded mounting pads assure flatness and facilitate bolting racks together with or without insulators.



EASY TO INSPECT

Open-type construction and individual indicating fuses permit quick visual inspection—note blown fuse link below.



Electric Power Cable Trade Names

Product	Company	Description
Style SC-100	Anaconda Wire & Cable Co	Service entrance cable, 2/C Underwriters' Type SE copper armor Type theft proof
Style SCF	" " " "	Service entrance cable, 3/C Underwriters' Type SE
Style SC-FA	" " " "	Service entrance cable, 2/C Underwriters' Type SE with flat steel tape over insulated neutral
Style SCF-100	" " " "	Service entrance cable, 3/C Underwriters Type SE
Style SCF-FA	" " " "	Copper armor type, theft proof service entrance cable, 3/C Underwriters' Type SE with flat steel tape over insulated neutral
Style SDC	Triangle Conduit & Cable Co	Service drop cable
Style SSD	Anaconda Wire & Cable Co	Exposed neutral-type Underwriters Approved service drop cable
Submarine	Hazard Insulated Wire Works	Moisture-resistant insulation now called Watertite
Sunex	Anaconda Wire & Cable Co	Jacket compound resistant to actinic rays of the sun
Sunex Security-flex	" " " "	Rubber-jacketed cables and cords
Super Coronol	General Electric Co	Ozone-resistant butyl insulated (80 C) wire and cable
Super-Eonite	U. S. Rubber Co	Heat and moisture-resistant natural rubber insulation
Super-Flex	Hatfield Wire & Cable Co	60% rubber-jacketed cords and cables
Super-Flex-Hatex	" " " "	60% rubber-jacketed cords and cables
Superlite	General Cable Corp	Thin-wall rubber insulation
Super PVX	General Electric Co	Non-metallic sheathed cable
Superseal	Anaconda Wire & Cable Co	Sealing Compound
Supersec	U. S. Rubber Co	Type RW building wire
Super Service	General Cable Corp	Heavy duty neoprene jacketed flexible cords and portable cables
Supersheath	" " "	Neoprene jacketed power and control cable
Supersheath Type USE	" " "	Neoprene jacketed underground service entrance cable
Supertuf	General Cable Corp	Lead cured jacket compound for portable cords and cables
Suprene	Collyer Insulated Wire Co	Neoprene sheathed Type RR
Surco	Surprenant Mfg. Co	Plastic-insulated wire and cable
Surety	Circle Wire & Cable Corp	R. C. building wire
Synrub	U. S. Rubber Co	PVC insulation, jackets, and insulated building wire
Synthinol	Rome Cable Corp	Polyvinylchloride thermoplastic insulation and sheath
Synthol	Crescent Insulated Wire & Cable Co	PVC insulation

T

Teleplated	Whitney Blake Co	Lead alloy coated copper plus brass coating
Teleseal	" " "	Neoprene jacketed wire for direct burial
Tempered Rubber	U. S. Rubber Co	Specially prepared tough rubber jacket
Temnernol	General Electric Co	Heat resistant Type RH compound
Tensilok	General Cable Corp	High temperature-annealed copper conductor
Thermax	" " "	Heat-resistant insulation
Thermax W	" " "	Moisture and heat-resistant insulation
Thermocable	Hazard Insulated Wire Works	Rubber insulated interlocking armor thermostat cable
Thermocon	Kennecott Wire & Cable Co	Special overhead conductor, annealing resistant
Thermoprene	Whitney Blake Co	Neoprene jacket Type RH
Thermoseal	National Elec. Products Corp	RW 60C-RH 75C dual-purpose wire insulation
Thinwol	General Electric Co	Cable with thin rubber insulation
Tiger Brand	American Steel & Wire Div, U. S. Steel Corp	All types of electrical wires and cables
Tip-Top	General Cable Corp	Neoprene-covered weatherproof wire
Tirex	Simplex Wire & Cable Co	Hard service, neoprene-jacketed cord or cable cured in lead
Titebilt	Habirshaw Cable & Wire Div, Phelps Dodge Copper Products Corp	Paper cable
Traprene	Triangle Conduit & Cable Co	Neoprene-sheathed cable
Trenchcable	Crescent I. W. & C. Co	Non-metallic parkway cable
Trenchlay	General Cable Corp	Fibrous armored cable for direct earth burial
Trenchlay UF	" " "	Single conductor underground feeder and branch circuit cable
Trenchwire	Crescent I. W. & C. Co	Single-conductor Type USE
Triadry	Triangle Conduit & Cable Co	Type RW building wire
Triex	" " " "	Non-metallic sheathed cable
Trioprene	" " " "	Non-metallic trench cable and dual rated cable
Trioseal	" " " "	Type TW wire
Triozone	" " " "	Cable with ozone-resistant qualities
Triplastic	" " " "	PVC thermoplastic insulated building wire, Type TW
Tru-Rip	Whitney Blake Co	POSJ portable cords
Twin Crescord	Crescent Insulated Wire & Cable Co	POSJ portable cord
Twin Cord	Belden Manufacturing Co	POSJ portable cord
Type AR	Anaconda Wire & Cable Co	Butyl higher-voltage cable
Type ABP	" " " "	Butyl-polyethylene all purpose higher-voltage cable
Type GPC	American Steel & Wire Div, U. S. Steel Corp	Gas pressure-compensated paper insulated cable
Type HT	American Steel & Wire Div, U. S. Steel Corp	Tree wire, high test ASA Standard
Type ML	" " " "	"Multi-lead" paper-insulated cable
Type PS	" " " "	Non-metallic shielding; non-metallic shielded cables
Type RSA	Anaconda Wire & Cable Co	Rural secondary cable

U

Unicord	General Electric Co	Electrical conductors and parts thereof; particularly connection cords with molded connector parts
Unilay	The Okonite Co	Insulated conductors or wire strands twisted in same direction for flexibility
Uscord	U. S. Rubber Co	Rubber jacketed cords
Usex	" " "	Non-metallic sheathed cable, Type NM
Uskorona 1	" " "	Heat, moisture, and ozone-resistant, oil-base insulation
Uskorona 2	" " "	Heat, moisture, and ozone-resistant Butyl insulation
Usrub	" " "	Rubber, rubber-like, and thermoplastic building wires and cables
Usurex		Non-metallic sheathed cable, Type NMC

V

Versatol	General Electric Co	Heat, moisture, and age-resistant insulated cable
Verticol	The Okonite Co	High-viscosity impregnant for paper and varnish cambric cables
Vitronamel	Anaconda Wire & Cable Co	Glass-fiber-insulated magnet wire enamel bond
Vitrotex	" " " "	Glass-insulated magnet wire
Vulcan	Paranite Wire & Cable Div, Essex Wire Corp	Rubber jacketed cords and cables
Vulcaprene	" " " "	Neoprene-sheathed cords and cable

W

Walkerflex	Walker Brothers	Non-metallic sheathed cable with R conductors
Walkerprene	" "	Type USE underground cables
Walker-T-Flex	" "	Non-metallic sheathed cables with T conductor
Watertite	Hazard Insulated Wire Works	Heat and moisture-resistant rubber insulation
Wrapseal	Anaconda Wire & Cable Co	Magnet wire coil with one-piece covering

Z

ZBF	Hazard Insulated Wire Works	Hazoprene flame-resisting neoprene sheath
Zipcord	U. S. Rubber Co	Type SP cords
Ziplite	" " "	Low voltage street lighting cable

DELTA-STAR *High Capacity* MK-40 SWITCHES

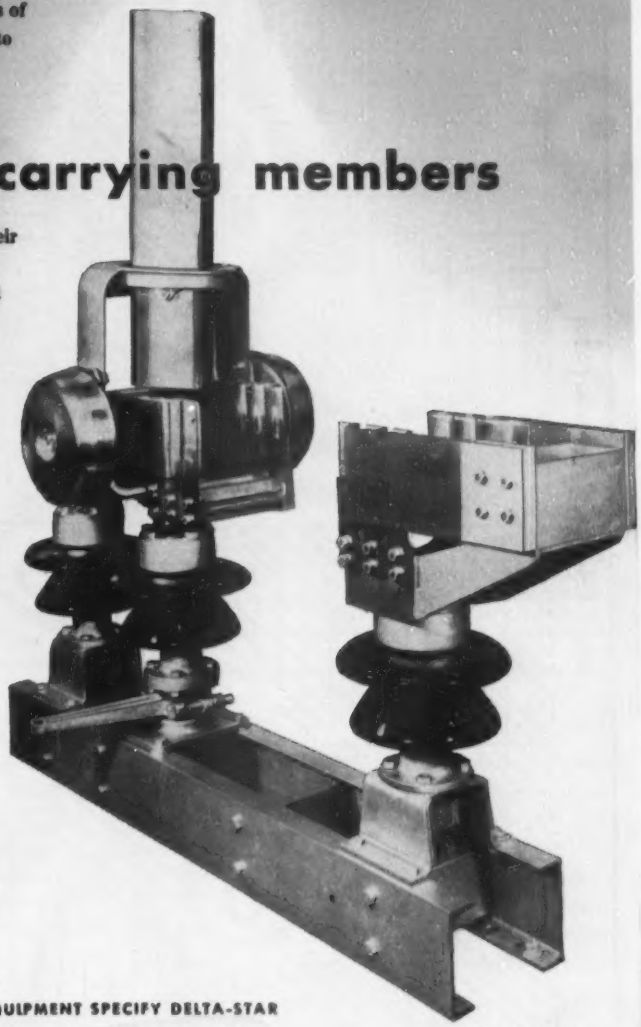
have straight line current path

Arrangement of silver-to-copper contacts at both ends of blade give a straight line current path from terminal to terminal. Identical contacts eliminate the need for cumbersome flexible shunts.

no cast current carrying members

All current carrying parts are hard drawn copper. Their large cross section and minimum number of current interchange surfaces provide a low resistance current path with ample material for heat dissipation.

Throughout the entire line from 7.5 KV to 69 KV and from 2000 amp. to 5000 amp. the same principal of blade mechanism is used. The fully controlled and counterbalanced blade is actuated by an enclosed ball bearing mechanism which rotates the blade about its axis and releases the high contact pressure before opening. Square tube blade automatically locks in both open and closed positions. The complete operation of opening or closing is under positive control during the complete cycle and is remarkably smooth and easy for switches of this size.



23 KV 4000 amp.
3-pole disconnecting switch

Delta-Star "MK-40" High Capacity group operated switches are available in ratings from 2000 to 5000 amperes; 7.5 to 69 KV inclusive for horizontal upright, underhung or vertical mounting.

Ask for Publication 4904

WHEN YOU WANT THE BEST IN HIGH VOLTAGE EQUIPMENT SPECIFY DELTA-STAR

DELTA-STAR ELECTRIC DIVISION

H. K. PORTER COMPANY, INC.
OF PITTSBURGH
2437 FULTON STREET, CHICAGO 12, ILLINOIS
DISTRICT OFFICES IN PRINCIPAL CITIES

Distribution Transformer Selection Chart*
6,000 to 9,000-Volt Range

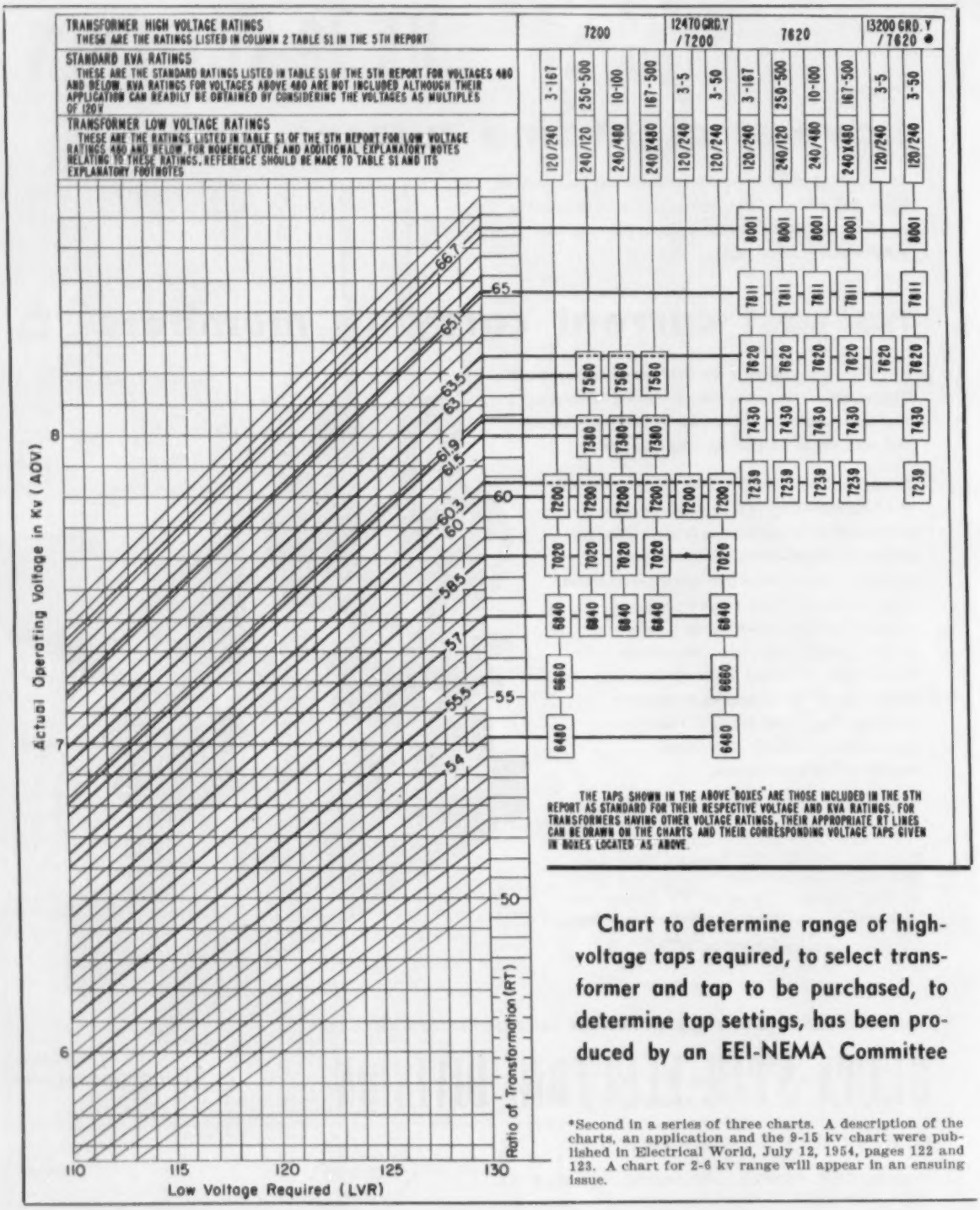
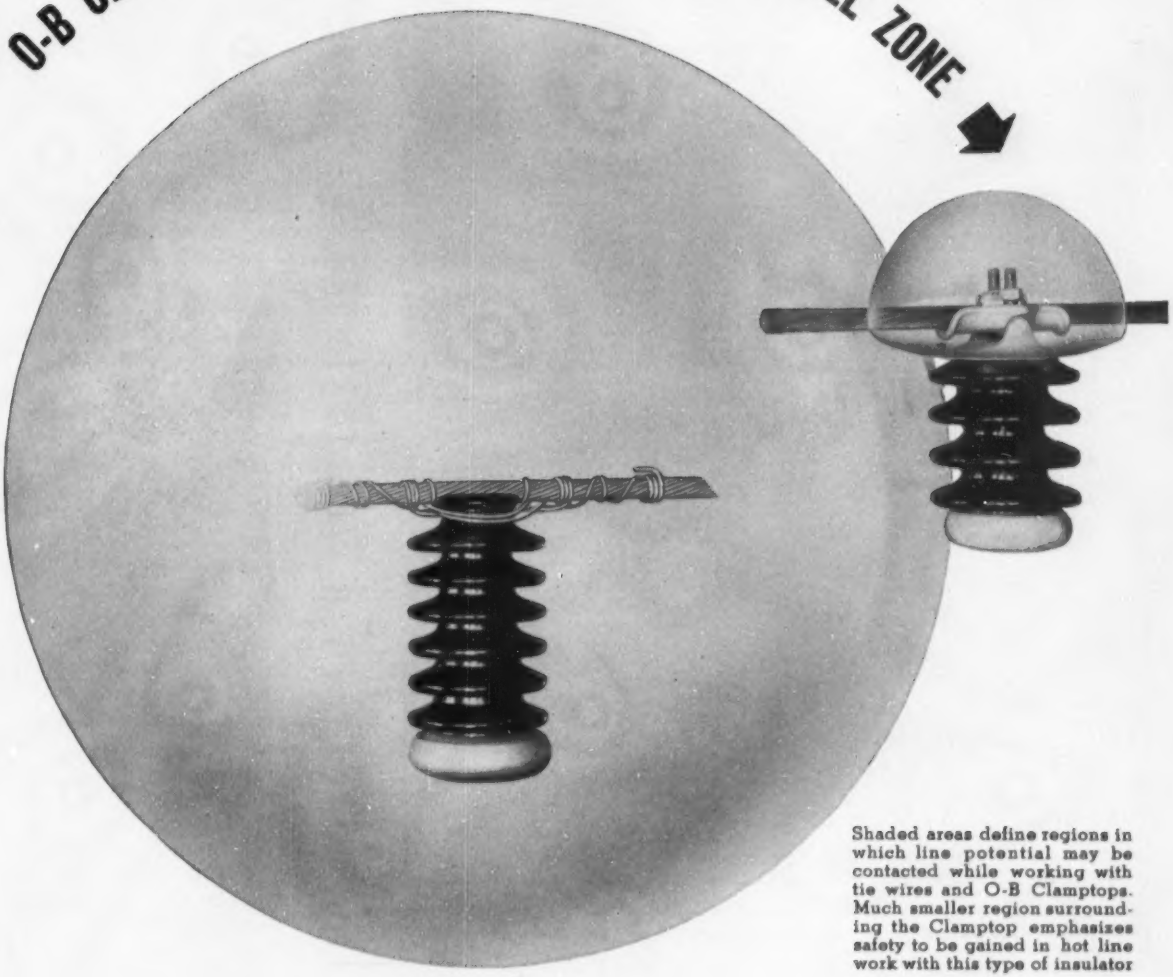


Chart to determine range of high-voltage taps required, to select transformer and tap to be purchased, to determine tap settings, has been produced by an EEI-NEMA Committee

*Second in a series of three charts. A description of the charts, an application and the 9-15 kv chart were published in Electrical World, July 12, 1954, pages 122 and 123. A chart for 2-6 kv range will appear in an ensuing issue.

O-B CLAMPTOPS CONFINE HOT WORK TO SMALL ZONE



Shaded areas define regions in which line potential may be contacted while working with tie wires and O-B Clamptops. Much smaller region surrounding the Clamptop emphasizes safety to be gained in hot line work with this type of insulator

O-B Clamptops cut down the hazard zone surrounding an insulator being worked hot. Line potential can be contacted in this zone, and opportunities for accident vary with the size of the hazardous region. Of course, there's a big safety advantage in keeping it as small as possible. O-B Clamptops, both in principle and design, hold the region at line potential to the smallest possible limits.

To point up the difference between safety values using Clamptops or tie wires, see the illustration here defining the regions through which tie wires or the energized tips of hot sticks might pass while in use.

Thus O-B Clamptops make a worthwhile contribution to safety in hot line work in three ways:

1. Reduced danger area
2. Improved hot line working methods
3. Improved attitude toward hot line work

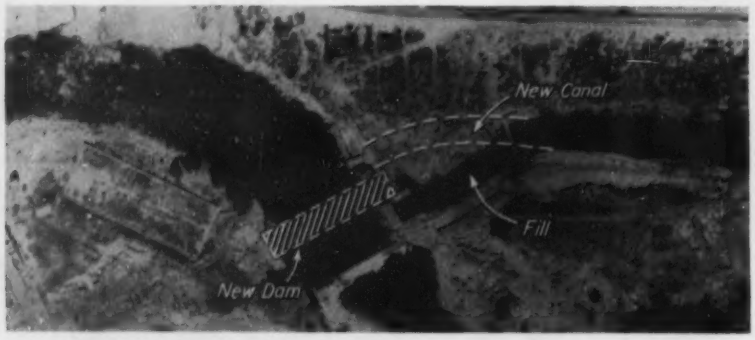
These benefits are available for your system. Ask your O-B representative to give you all the details!

Ohio Brass

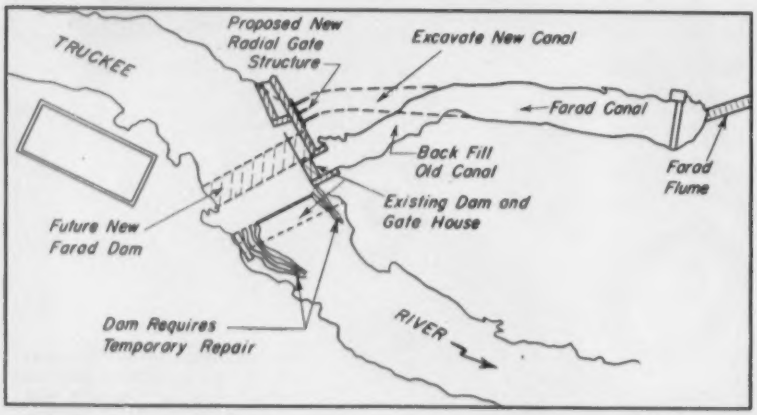
MANSFIELD OHIO, U.S.A.

4498-H

Aerial Photos Showing Job Proposals Cut Field Work



PROPOSED CHANGES in diversion works at existing dam are added easily to aerial photo. Clearly shown features of terrain aid making clear interpretation of the situation



LACK OF DETAIL in drawing of proposed changes hampers efforts of the engineering department in presenting proposal to management and increased need for survey and mapping

Spot aerial photographs of properties and plant to be altered or improved save considerable time and money in presenting the plans to the management of Sierra Pacific Power Co, Reno, Nev. This method not only reduces the time required for field surveys and mapping but also allows the engineering and construction departments to make a clear and concise interpretation of the situation.

For a cost of about $5 per photo, including flying time to take from 10 to 40 shots, many details of existing features are presented. Use of photos allows proposed plans and revisions to be added and reduces the need for preliminary drawings.

In the instance illustrated, Sierra Pacific Power had to replace a hydro diversion gate and add a new waterway. A local photography service provided enlargements from negatives taken by company personnel. Proposed changes were added in ink on semi-mat paper for consideration by management. Semi-mat paper is preferred because it also will take pencil or crayon markings.

Spot aerial photos were used advantageously to discuss right-of-way for access to the dam, for right-of-way of an H-frame transmission line to the substation, and improvements of water works properties.

Galvanic Action Corrodes Through Bolts

FRED M. REITER Material Research Engineer, Dayton Power and Light Co, Dayton

After crews of Dayton Power and Light Co brought in several badly corroded through bolts that had only been in service from one to two years, an investigation was launched to determine the cause. The corroded bolts were discovered while making routine changes in the distribution system. Corroded bolts were found only in poles where they supported transformers.

Galvanic action appeared to be the cause of the corrosion. A test was set up using a section of pole where corroded bolts had been found. Three heel bolts were weighed and installed in the pole section. One bolt was installed in the wood. One was grounded to grounding material. One was grounded to a copper bearing transformer bracket.

Loss of zinc in these bolts indicated that all zinc in grounded bolts would be eaten up within one year. The apparent cause was galvanic action set up by the dissimilarity of the metals in the pole section plus the low resistance of the pole section. Measured resistance of the two-foot section of pole was 6,000 ohms.

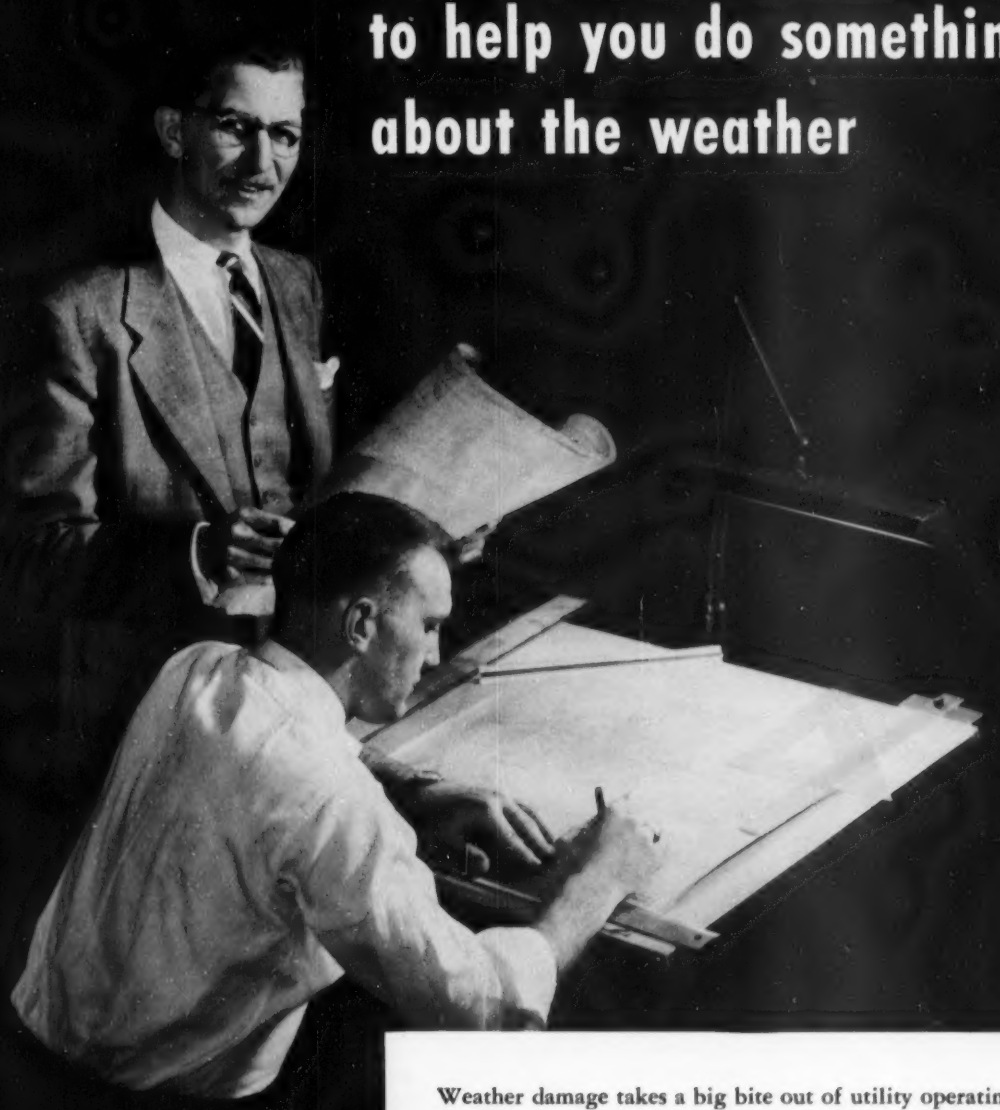
Investigation revealed that apparently there were only a few poles on the system that would support such galvanic action. Tests were made to determine what there was in the pole that would contribute to the condition. They showed that the pole section

(*Continued on page* 127)

Correction, Please

To Belmont (Mass.) Municipal Light Department instead of "Boston," belongs the credit for the article entitled "Sliding Panels Facilitate Examining System Maps" (EW, June 28, p. 132).

Equipment design to help you do something about the weather



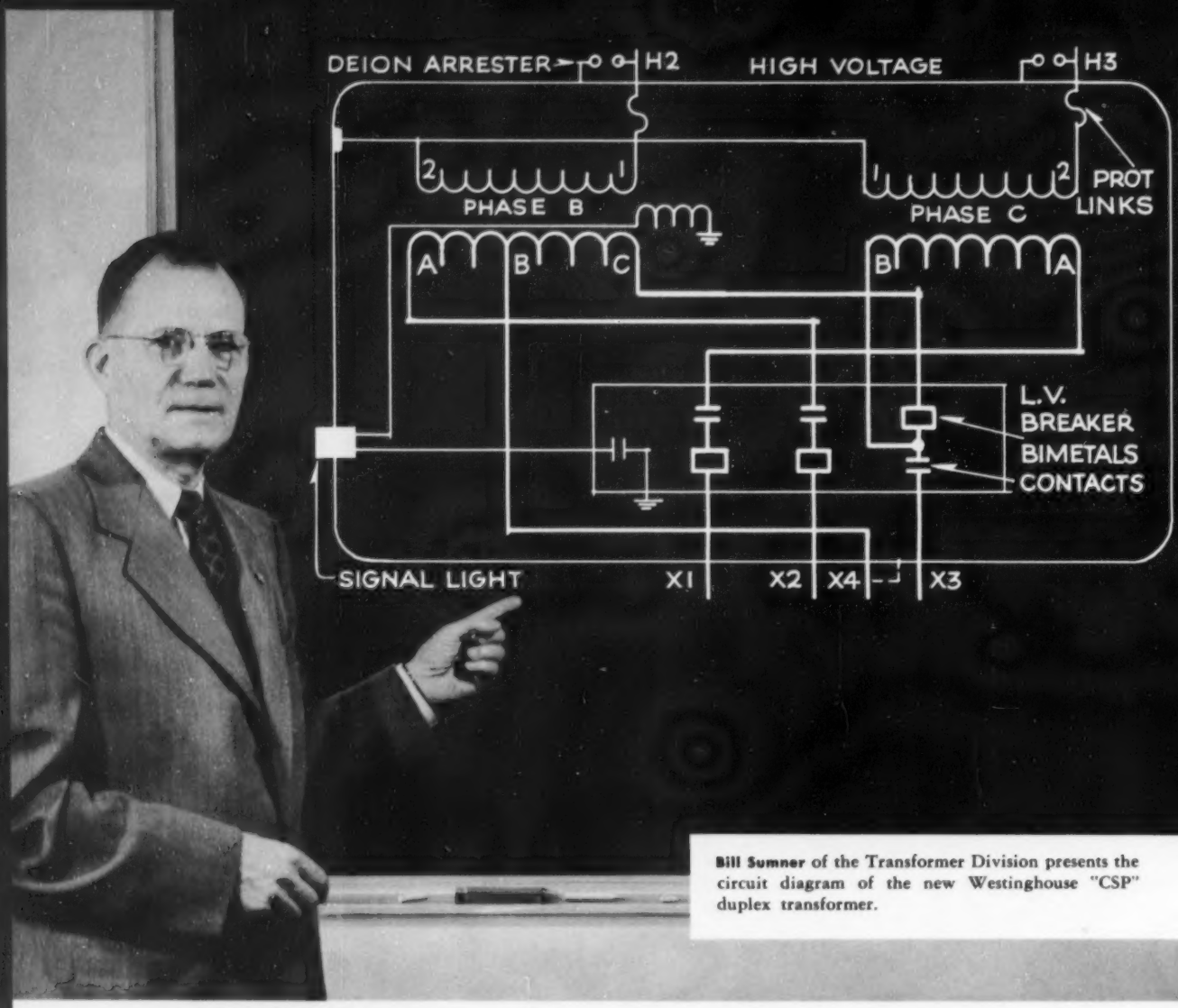
Weather damage takes a big bite out of utility operating budgets every year. This toll can be reduced by improved characteristics in many major items of equipment.

On the following seven pages, Pascal Beckjord, Manager, Customer Section, Westinghouse Electric Utility Sales, shows the progress being made along these lines.

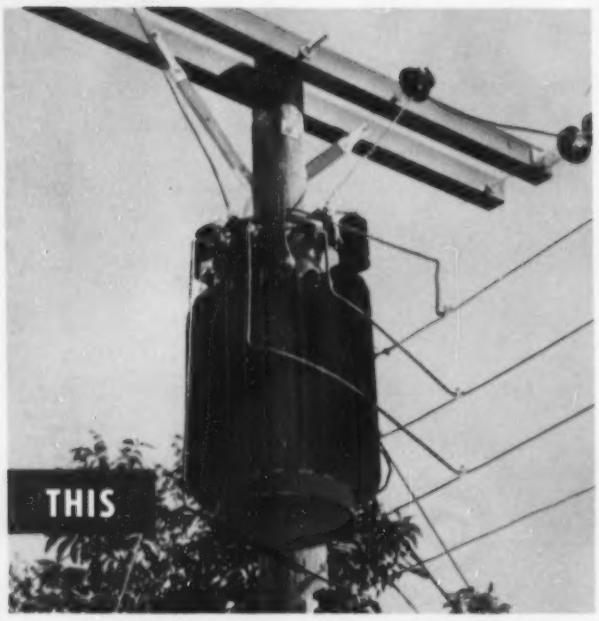
Bill Sumner, Division Manager, Distribution Transformer Engineering Department, starts out the discussion on the next two pages with an interesting new transformer development.

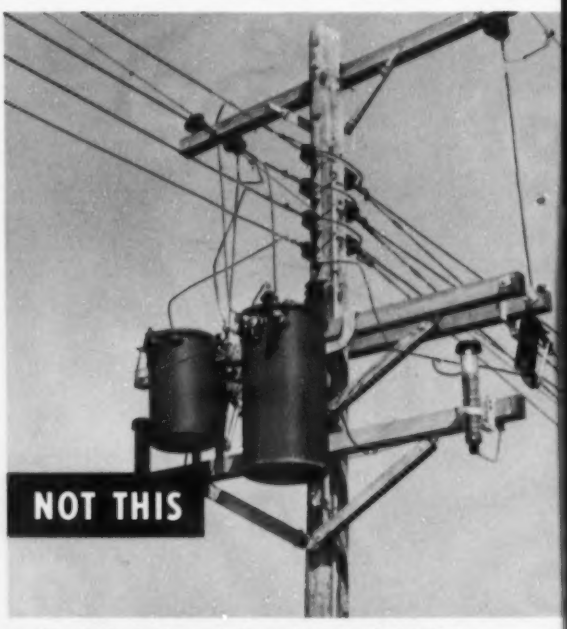
YOU CAN BE SURE...IF IT'S

Westinghouse



Bill Sumner of the Transformer Division presents the circuit diagram of the new Westinghouse "CSP" duplex transformer.





A single Westinghouse "CSP" duplex transformer (left) supplies both single- and three-phase loads. It's light enough to mount directly to the pole. It replaces the two transformers and extra crossarms shown at right.

New "CSP"® duplex transformer takes the heat off summer load peaks

As you know, summer load peaks caused by the increased use of air conditioning can create load problems in certain areas. The new Westinghouse "CSP" duplex transformer answers this problem by supplying *both* single- and three-phase loads from a single unit, with the extra benefits of "CSP" protection.

The "CSP" duplex has two different ratings of single-phase core-coil assemblies connected in either open wye or open delta on the high-voltage side and open delta on the low-voltage side. A midtap is taken from the larger assembly for the single-phase load, while three-phase power is taken at the same time from the open-delta connection.

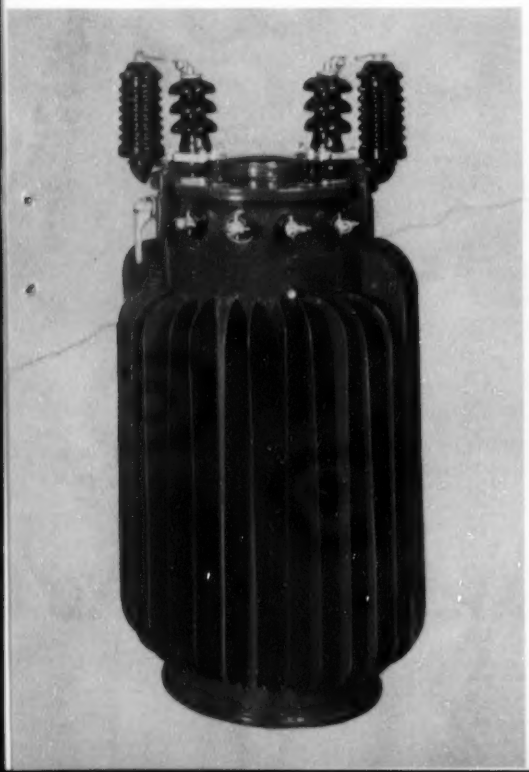
You get lower installation costs because no extra crossarms are necessary. The "CSP" duplex can be mounted directly to the pole. Obviously, it's easier and faster to install one unit instead of two.

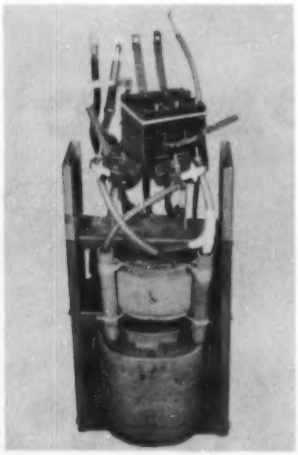
Complete protection against internal and external faults is another feature of the "CSP" duplex transformer with built-in lightning arrester, circuit breaker and protective links—all coordinated at the factory with transformer insulation level.

Add to these such practical benefits as neater pole tops, less space required for warehousing, and the new "CSP" duplex transformer makes an attractive package—one which can aid greatly in solving a transformer problem created by the weather.

On the next two pages, Al Opsahl, Lightning Arrester Engineer, points out a lightning arrester advancement and Gil Easley, Power Circuit Breaker Engineer, talks about the weather and power circuit breakers.

YOU CAN BE SURE... IF IT'S Westinghouse





Extra transformer capacity is actually possible with the "CSP" duplex transformer. With open delta, the large and small core-coil assemblies are arranged to take advantage of the difference in the power factor of the single- and three-phase loads, thus the winding current is actually reduced. Extra transformer capacity is thereby available without exceeding temperature rise. Note in the illustration at the left that the "CSP" duplex transformer has two high-voltage bushings—one for each phase—with a ground terminal on the tank for the neutral connections.

New characteristics assure superior arrester performance

Al Opsahl, Lightning Arrester Engineer, tells why SV and LVS arresters give you the best protection available.

Here's new weather-beating performance in an arrester design that has been *proved* completely sound in over 14 years of field experience.

Maximum discharge voltages of Westinghouse SV (station) and LVS (line) arresters have been lowered to give you the greatest protective margins available in high-capacity arresters (see table below). This was achieved through improved Autovalve® block manufacturing and testing techniques. Impulse sparkover values for the LVS have been reduced without reducing the 60-cycle sparkover. New pressure relief diaphragm relieves severe gas pressures in event of internal short circuit.

To give you all these performance pluses, no basic design changes were necessary. Retained are all these time-proved features: exclusive moisture-proof solder seal; aluminum alloy end castings; separately sealed gap assemblies; surge capacities well above industry standards.

Don't take a chance on weather—or unproved arrester designs. Get Westinghouse SV and LVS arresters—now more than ever, the best lightning protection your system ever had.

Maximum discharge voltages, kv crest, for the following discharge currents in amperes crest, 10 x 20 microseconds

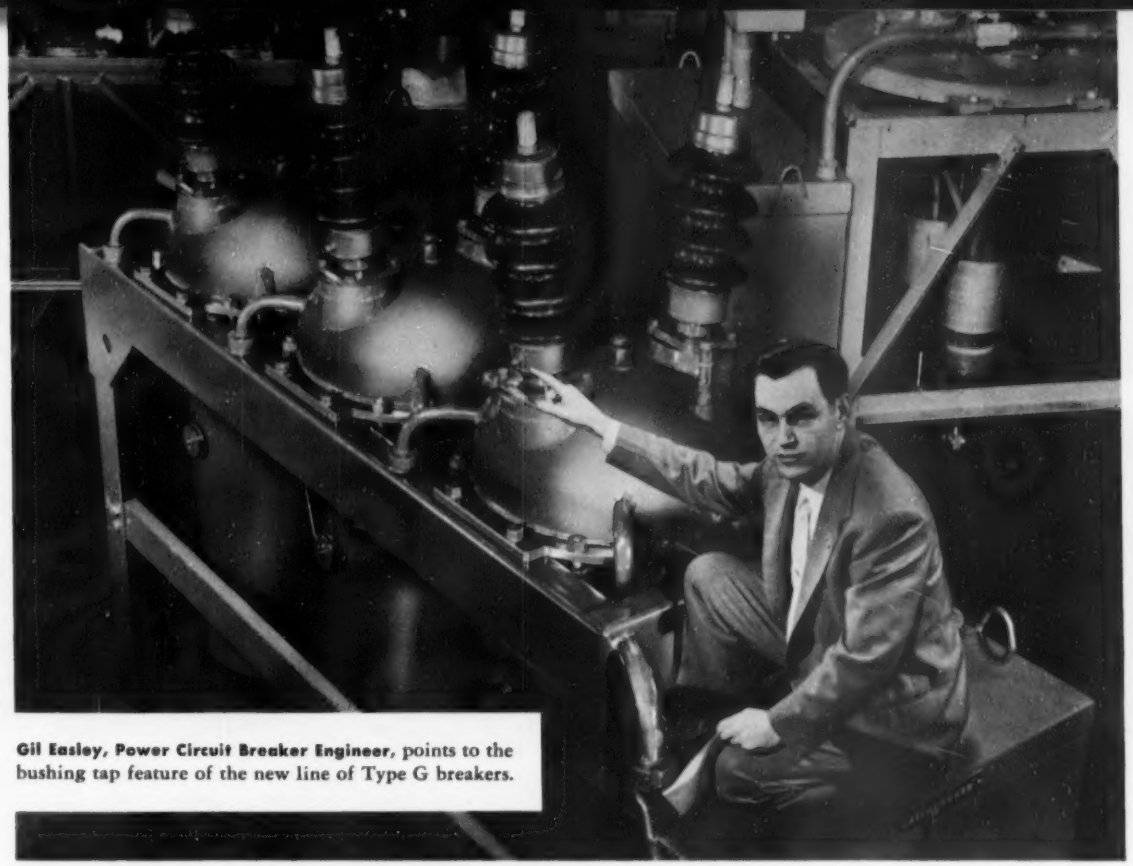
SV ARRESTERS

Arrester Rating Kv Rms	1500	5000	10000	20000	100000
12	29	34	37	40	50
30	73	85	93	100	125
73	178	206	225	245	305
195	475	550	595	645	810

LVS ARRESTERS

Arrester Rating Kv Rms	1500	5000	10000	20000
12	35	41	45	50
30	86	101	112	124
73	220	262	290	320

YOU CAN BE **SURE**...IF IT'S



Gil Easley, Power Circuit Breaker Engineer, points to the bushing tap feature of the new line of Type G breakers.

New Type G breakers streamlined to combat weather factors, simplify maintenance

The big news in frame-mounted circuit breakers is the redesign of the complete line of Westinghouse Type G breakers, 14.4 through 69 kv, to give you the most weather-resistant—most easily maintained breakers available.

The breakers are streamlined—clean and uncluttered in appearance. Domed tops make possible the elimination of external lever boxes and transformer secondary conduit and condulets—affording much greater protection against moisture and greatly simplifying maintenance. Frames are simpler, yet sturdier, with bushing current transformer secondary leads enclosed in the top frame member. Tanks have a new shape—a wider base for greater stability when lowered, either full of oil or empty.

The new design retains the solder-seal condenser bushing but provision is also made for ungrounded power factor testing—a convenient method that involves only disconnecting a bushing tap. A Kovar® seal on the tap backs up the solder seal that absolutely excludes moisture from the bushing.

"De-ion®" grid interrupters—used in previous designs and proved by years of field experience—have been retained in the new design. Even so, interrupting ratings of the new breakers have been reverified by tests in the High Power Laboratory. The breakers will be equipped with mechanically trip-free AA-7 and AA-10 pneumatic mechanisms or with solenoid mechanisms.

On the next two pages, Gino Marleni, Relay Design Engineer, discusses relay protection for transformers and Jack Hoffecker, Large Power Transformer Sales Manager, presents a transformer design that helps win the lightning battle.

Westinghouse

CA-5 relay decreases transformer outages

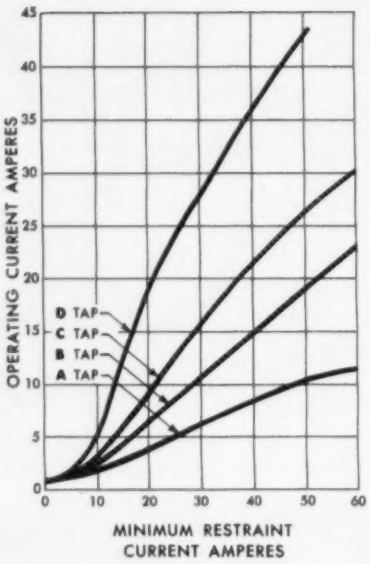
Lightning strokes on transmission or distribution lines can result in heavy faults with accompanying high-current flow. When the fault is external to transformers on the line, it is preferable to trip off the faulted lines and allow the transformer bank to stay in service. The result is better customer service—less loss of revenue.

Heavy external faults may cause the current transformers to depart from their true ratio and thus feed unbalanced currents to the differential relays, falsely indicating a possible internal fault.

The operating characteristic shown in the chart at the right indicates how the Westinghouse CA-5 *variable* percentage differential relay eliminates the possibility of false trip-out. The CA-5 variable-tap adjusting transformer permits *control* of the sensitivity of the relay operating element.

The relay is highly sensitive to light, internal faults within the transformer bank. At the same time, the reduced sensitivity at higher currents allows the current transformers to depart from their true ratio without causing false tripping due to external faults.

In your battle against weather, the CA-5 relay is worth consideration both from a protection standpoint and outages of key equipment.



Gino Marleni, Relay Design Engineer, points out CA-5 relays used for transformer protection.

Jack Hoffecker, Manager, Large Power Transformer Sales, points out proper application of insulation in Form-Fit coil group.

"Creepage" paths eliminated in Form-Fit design

When a power transformer is subjected to a voltage surge, any potential creepage paths along insulation surfaces may result in failure. In recognition of this problem, Westinghouse engineers for many years have designed insulation structures to prevent internal corona, thereby eliminating the possibility of transformer damage from this cause.

As you know, insulation is much stronger in puncture than it is in "creep". By interleaving solid insulation so that it follows the equipotential planes around the high-voltage coils, between them and the low-voltage coils and the core; and on the corners where stress is high, creepage paths are eliminated. In addition, by rounding the corners, stresses are spread over larger areas, reducing unit stress gradients. Jack Hoffecker points out, in the Form-Fit coil group shown above, how proper application of box-type insulation has made use of these principles. Note also how the tap changer is insulated to eliminate creepage along the shaft by confining the stress to the oil between the rounded surfaces of the bells. Even the tap changer contacts are insulated from the board to avoid creepage. Again, stresses are confined to the oil.

Such strict attention to detail is your assurance that Westinghouse Form-Fit power transformers are engineered throughout to meet the worst of surge conditions with adequate margins of safety.

On the next page, John Chiles, Engineering Manager of the Transformer Division, discusses economic factors in insulation design. →

YOU CAN BE SURE...IF IT'S

Westinghouse

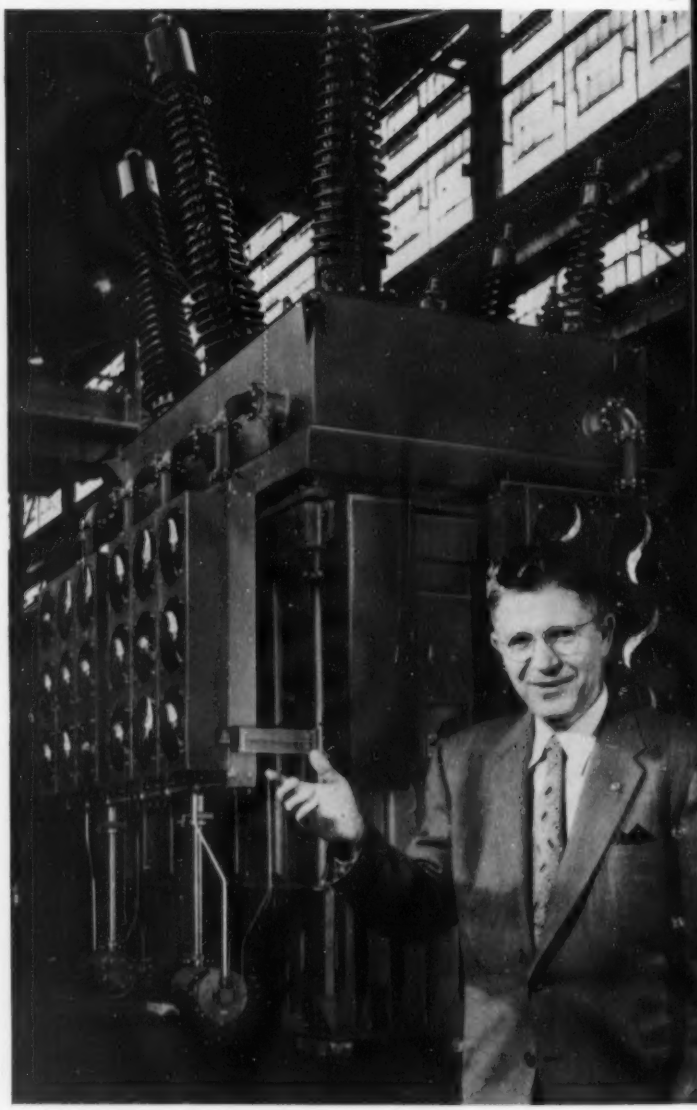
Proved: Reduced insulation levels meet both weather and cost requirements

With utilities cooperating, much progress has been made in applying power transformers of reduced insulation levels to high-voltage systems that are solidly grounded and protected against lightning. Based on this cooperation, Westinghouse has been able to pioneer successively lower levels of insulation.

The application of reduced basic insulation levels is particularly adaptable to Westinghouse Form-Fit power transformer design. Its inherently high coil-to-coil and low coil-to-ground capacitance minimizes voltage oscillations. This permits the resulting stresses to be calculated with ease so that the required amount of insulation can be readily determined . . . without resort to models or prototypes. What does this mean to you?

Simply this: While maintaining margins which provide vital reliability—the key to continuity of service—you get a lighter, smaller transformer, a transformer with lower impedance and losses, minimized handling and installation problems . . . all of which add up to a better transformer at less cost!

Get detailed product facts . . .
from your Westinghouse representative. Or—if you prefer, you may write direct to Westinghouse Electric Corporation, 3 Gateway Center, P. O. Box 868, Pittsburgh 30, Pa.



John Chiles, Engineering Manager of the Transformer Division, at a Form-Fit power transformer.

YOU CAN BE SURE...IF IT'S
Westinghouse

CP-1021

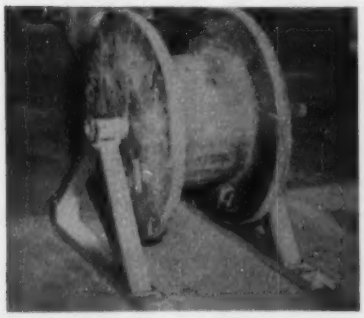
Corroded Bolts

(*Continued from page* 118)

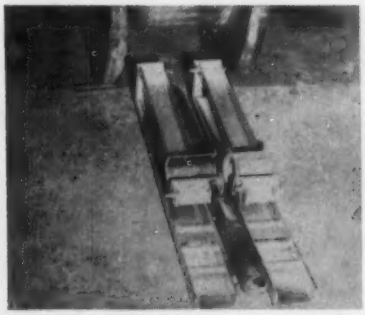
contained some sodium chloride, acetates, carbonates, chlorite, and sulphates. There was above normal moisture content. It was considered possible that too-high a treating temperature may have been responsible for the formation of acetates in the poles.

All the bolts that were found corroded in service were supporting transformers where the transformer case was grounded. Copper-clad staples and bronze grounding clips had been used. This, with the galvanized bolts, introduced dissimilar metals into the pole, setting up the conditions for galvanic action.

As a result of these investigations the use of different kinds of metals in the same pole has been eliminated although it appeared that trouble from this condition would occur only under infrequent pole conditions.



CHANNEL IRONS are primary members in stand that cost $49 for material and labor



LITTLE SPACE is taken up by parts that measure 42 in long, 5 in. high, 4 in. wide

Folding Stand Handles 42-In. Reel

MELVIN T. KOOMPIN, Idaho Power Co, American Falls, Idaho

A folding reel stand that handles up to three reels has been designed and built for use by Idaho Power Co. The stand consists of two identical parts, each weighing 40 lb and folding into a unit measuring 42 in. long, 5 in. high and 4 in. wide. Total cost of the stand is $49, including materials and labor.

When set in position, the stand will handle reels up to 42 in. in diameter. Base of each units is a 42-in. length of 4-in. channel iron. Two 6½-in. lengths of 2-in. channel were welded at one end to form an L-shape. At the other end of the base angle, lengths of ¾-in. round stock were welded 4 in. from the end on 3-in. centers. Four holes in the base plate allow it to be bolted permanently to a truck bed or to cross planks for stationary operation.

Arms of each half of the stand consist of lengths of 3-in. channel. The longer piece—27 in.—attaches to the toe of the L with a ½-in. steel pin. The other end of this arm is reinforced with ¼-in. plate to take the saddle for a 2½-in., double-strength, steel reel pipe.

On the reel end of the saddle, a spacer is welded to hold the reel away from the stand. A ½-in. pin goes through the saddle and bears directly against the reel bar. This pin helps to minimize side play when wire is being unreeled and allows the stand to be used on any side hill over which the truck may be driven with safety.

The other arm—22 in.—of each stand connects to ears on the reinforcing saddle plate with a ½-in. pin. This arm's other end is finished with ¾-in. round stock that aids in placing the arm between the bars on the end of the base. The round stick also keeps the arm from moving up and down as wire is withdrawn.

When placing a loaded reel on the stand, the reel pipe is placed through the reel and the saddles on each side are held against the pipe by the saddle pins. A winch line is looped around the reel and is gently taken up. This raises the reel and allows the training arms to fall between the bars on the base. The reel also may

DUXSEAL®
plugs 'em
fast-to last!

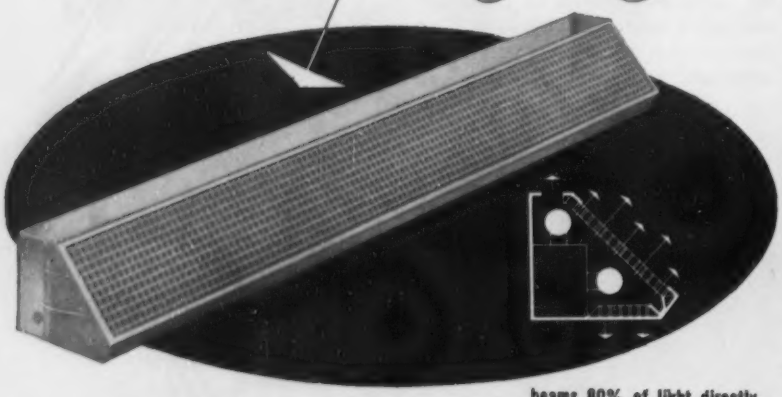
DUXSEAL is a nonhardening adhesive plastic compound made with an asbestos base. It is the ideal general utility sealing and caulking compound for duct openings, potheads, bushings, terminal boxes, and for filling multi-wire contact boxes indoors. Use it like putty, just as it comes from the handy package, for smooth, workmanlike jobs.

Duxseal stays plastic—will not slump, melt or run under ordinary temperatures. Clings to duct walls and cables but flexes with expansion and contraction. It is unaffected by water and gases, does not react with rubber, metals or painted surfaces. For full information write Johns-Manville, Box 60, New York 16, N. Y. In Canada, 199 Bay St., Toronto 1, Ontario.

JM

Johns-Manville
SEALING COMPOUNDS

a brand new slant on cove lighting

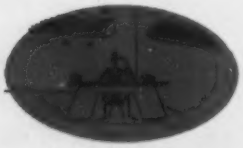


GUTH GRATELITE* LUMINOUS COVE

(the 2-in-1 bracket) (TM Pats. Pend.)

An exciting new look. Sparkling—like a superb diamond! Classic beauty and workmanship in the Guth tradition. ***It's the new*** fashion in Cove lighting made possible by GRATELITE: low brightness, high efficiency, excellent diffusion, low upkeep.

beams 80% of light directly upward and outward!
beams 20% of light downward to brighten side walls!
perfect shielding in 45° x 90° zones by GrateLite!



as luminous indirect cove

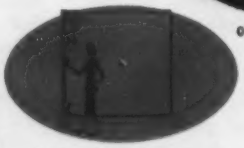
in fitting room

in barber shops

over hospital bed

LOOK! YOU CAN TURN IT OVER, TOO! Mounted "upside-down"—it solves dozens of tricky lighting problems where downward and outward beams are needed.

Write on your letterhead today for Bulletin 929-H.



chalkboard downlite with cove

*U. S. & Can. Pats. Pend. TM Reg.

Guth

THE EDWIN F. GUTH CO. • ST. LOUIS 3, MO.

Leaders in Lighting since 1902

be raised into position using a light pry iron and a small chocking block.

In one operation the reel stand was fitted with a long length of 2-in. pipe and satisfactorily handled three reels of wire weighing 2,400 lb each.

STORAGE RACKS save space, double transformer storage capacity, and cut travel time

Platforms Double Transformer Storage

R. C. DAFFRON, System Distribution Supervisor, Virginia Electric & Power Co, Richmond, Va.

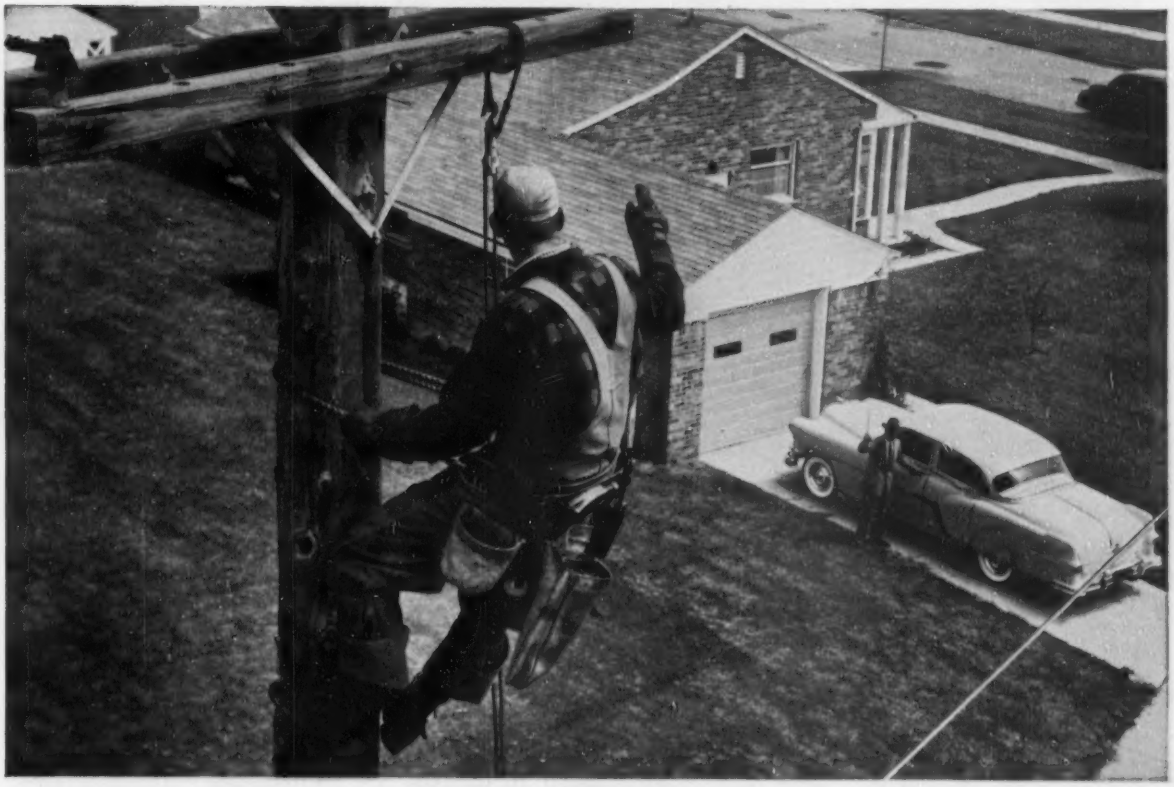
The use of double-deck racks for storing transformers at the service building of the Virginia Electric & Power Co, Richmond, Va., has doubled the capacity of the storage yard and eliminated a considerable amount of time and travel in hauling transformers from other storage locations. Previously, the limited space made it impossible to carry the entire stock of transformers at construction headquarters.

The elevated transformer platforms are constructed of bolted and braced angle irons and 2-in. creosoted boards. Transformers are raised to and lowered from the platform by a fork lift truck. It is not necessary to provide a wide aisle space as a short sling is placed over one arm of the fork. The fork is raised and then extended, setting the transformer in place. The fork lift truck remains in a position parallel with the line of transformers.

Before installing these elevated racks, the transformer platform was very crowded. Now there is room for a number of years' growth. Transformers to be used first are kept on the lower level for easier handling.

DOW

PENTA *is the clean, modern wood preservative that gains good will wherever used*



Penta-treated poles win praise from civic authorities, the public—and your own line crews

PENTA-treated poles and crossarms are used more widely every year. *Clean* PENTA* meets the strictest civic requirements, builds good will in the neighborhood—and is preferred by linemen because PENTA makes wood easy to climb and handle.

There's *another* big reason light and power companies use more PENTA-treated poles and crossarms. PENTA checks decay and termites to give wood added *years* of serviceability . . . cuts repair and replacement costs under severe climatic and soil conditions . . . saves thousands in maintenance *annually*.

Over 60 suppliers across the country can provide PENTA-treated poles of carefully controlled uniform quality. Ask *your* regular supplier about the advantages of clean *PENTAchlorophenol, the *modern* wood preservative that gives protection you can *actually measure* in the wood. For additional information, write THE DOW CHEMICAL COMPANY, Midland, Michigan.

THE DOW CHEMICAL COMPANY
Dept. PE 748B, Midland, Michigan

- ☐ Send me free information on PENTA-treated poles and crossarms.
- ☐ Send me a list of PENTA-treating plants.
- ☐ Tell me how PENTA protection can actually be measured.

Name_____

Title_____

Company_____

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City_____ Zone____ State_____

you can depend on DOW CHEMICALS DOW

NEW GROUPS OF INSULATORS which will be announced soon by Lapp Insulator Co bring together the sales executives to discuss a sales program. Left to right are Brent Mills, sales manager; M. L. Church, sales engineer; Ralph Jenner, president; and standing, John Innes, assistant sales manager. Church is holding a sidewall transformer bushing. Two post insulators are on the table at the left. Other four units are indoor bus supports

Lapp Will Add Insulator Items

New transformer sidewall bushing, 3 types of indoor bus supports, and 2 post insulators will be introduced to industry

A group of new insulator items—a transformer sidewall bushing, three types of indoor bus supports, and two post insulators—will be announced soon by the Lapp Insulator Co, Le Roy, N. Y.

The sidewall distribution transformer bushing will be offered as an assembled unit with the transformer internal lead crimped to the bushing stud. The design is suitable for use with both copper and aluminum and includes contacts supported by the pressure of a stainless steel spring effective in compensating for conductor flow or other distortion. Gasketing is suitable for use with both transformer oil and askarels.

The indoor bus supports were designed for various voltages, strengths, and to meet BIL values. A back-connected switch bushing is available with electrical and mechanical values and physical dimensions to match each front-connected insulator. Three types of insulators are included: double-recess with two inserts, outside-bonded base with insert at the top, and outside-bonded base with cap.

Two post insulators for distribution applications have solid porcelain cores and are reported to be puncture-proof. The bracket is a new piece, lighter and less expensive. The larger unit with a 27-kv rating is intended for the popular 23 and 25-kv circuits.

Research and development work on porcelain, higher-voltage post insulators, transformer bushings, and other porcelain electrical applications will be advanced and speeded by the facilities now available in the new John S. Lapp High-Voltage Laboratory (EW, May 3, p 154). This laboratory will be able to handle 60-cycle testing at over 1 million v and impulse testing at 2.5 million v as well as high current testing.

Federal Electric and Pacific Electric Merge

Federal Pacific Electric Co is the new name for the organization formed by the merger, July 1, of Federal Electric Products Co, Newark, N. J., and its wholly owned subsidiary, Pacific Electric Manufacturing Co, San Francisco.

The company has ten plants throughout the United States. Combined facilities provide for the production of high-voltage outdoor switchgear and related equipment, also low-voltage distribution equipment such as switchboards, motor controls, safety switches, bus duct, and the "Stab-lok" circuit breaker.

Portable Atomic Plant Designed by AM&F

A model of a "packaged" atomic power plant has been presented to the United States Information Agency by American Machine & Foundry Co. The latter designed and built the display at the request of the Agency.

This is reportedly the first model of a "transportable power plant" ever shown to the public. It is basically similar to that used in the atomic submarine.

The plant can be offered commercially when government restrictions are lifted. Components can be transported into a remote area where they can be assembled and put into operation.

Built as a 1/24th-scale model, the reactor is a pressurized water type. Capacity of the unit is between 1,000 and 10,000 kw when operating on enriched uranium as a fuel.

Aluminized Wire

An aluminum coated wire is being made by American Chain & Cable Co in a pilot plant at Page Steel & Wire Division's Monessen, Pa., plant. A new continuous hot-dip process is said to provide accurate control of both thickness and weight of coating. Designated as ACCO aluminized wire, it is reported to have good corrosion resistance and can be drawn to any desired thickness.

Give the Guy a CHANCE

Build lines to stay

with the CHANCE 8 Way

MIKE THE MOLE SAYS:

Only a mole can tell what goes on below "see" level!

Here's a typical example of a test result . . . This 200 square inch Chance 8-Way was pulled to nearly double its rated load without damage to the anchor.

MIKE'S RIGHT! You can't tell what happens to an anchor after it's installed unless it fails—or is pulled out in a test or dug out for examination. Chance has pull-tested all kinds of anchors all over the country to see what happens when anchors are subjected to heavy loads. These tests prove that the Chance 8-Way holds far more than its rated load because the eight blades expand to form a complete pyramid shaped square—there is no wasted space between blades. The guy load is equally distributed all around the hole.

8-Ways are available in a range of sizes for every requirement from guying rural phone lines to guying heavy transmission lines. There is a CHANCE Anchor Distributor in your area who can probably fill your order directly from stock. SPECIFY CHANCE FOR SERVICE!

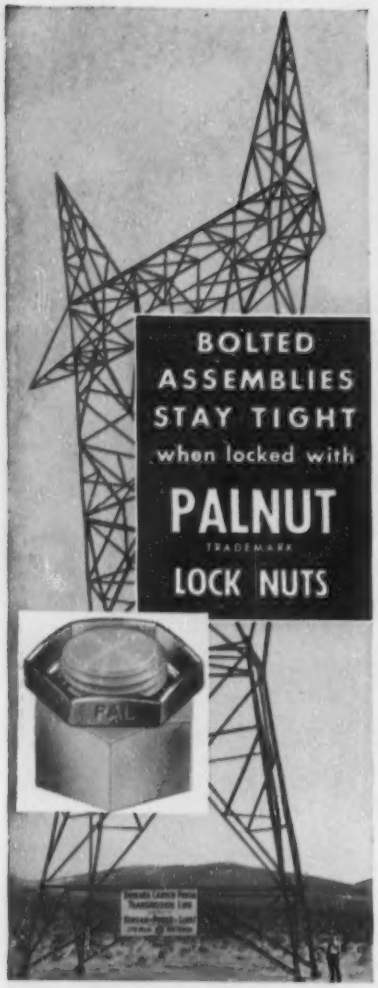
ABC INDUSTRIES

A·B·CHANCE CO·

CENTRALIA, MISSOURI

SAN FRANCISCO, CALIFORNIA

ANCHORS • GUYING FIXTURES • LINE CONSTRUCTION TOOLS • CONDUCTOR CLAMPS
GROUNDING EQUIPMENT • HOT LINE TOOLS • HIGH VOLTAGE SWITCHES • CUTOUTS



Specify PALNUTS on new lines . . . add PALNUTS to existing lines, to eliminate further re-checking and re-tightening of bolts. PALNUT Lock Nuts are the lowest cost, most dependable method of locking steel tower bolts. Once tightened, their double locking spring action holds tight under severest vibration.
PALNUTS are extremely low in cost, require only 3 bolt threads, apply fast, may be removed and reused. Hot Dip Galvanized and other finishes and materials used by utility industry. Free samples on request.

The PALNUT Co.
51 Cordier St.
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PALNUT
TRADE MARK
LOCK NUTS
for quick, secure fastening at low cost

New Steam Generators Cheer Coal Industry

The electric utility industry is bringing some joy to the gloomy coal industry. Figures released by Coal Age, a McGraw-Hill publication, indicate that the generating units going on the line by the end of 1958 will increase coal burning capacity by a total of 61 million tons.

This is broken down by years into 17 million tons for equipment added this year, 15 million for 1955 and 1956, 8 million for 1957, and 6 million for 1958. The figures for 1957 and 1958 will go up as additional steam generating units are scheduled.

Total coal-consumption capacity of the utilities is estimated at 132 million tons this year. The estimate for the end of 1958 is 176 million.

The foregoing estimates were made in the Keystone Coal Buyers Manual, a Coal Age affiliate.

Westinghouse to Build Test Center-Sound Lab

A multi-million dollar sound laboratory and test center for power transformers will be built by Westinghouse Electric Corp for operation early in 1955. The new facilities will be housed in an extension to the Transformer Division's Sharon Works.

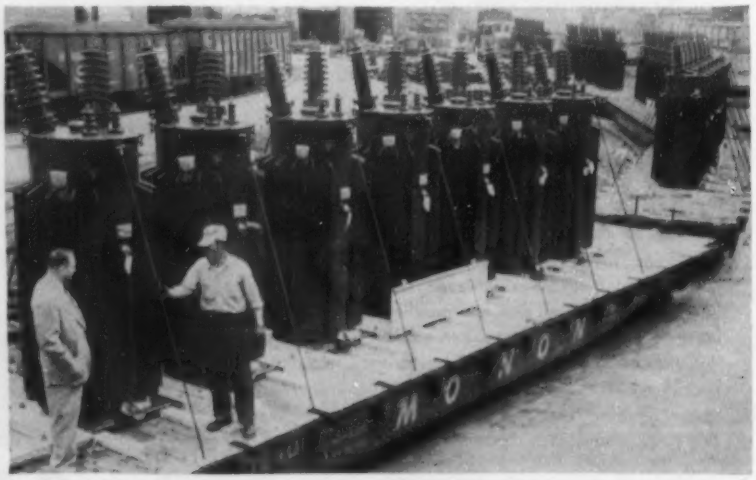
The sound laboratory will be large enough to test transformers weighing up to 400 tons and rated at greater than 500,000 kva. The test center will be an enlargement of present testing facilities built approximately 20 years ago.

MANUFACTURING BRIEFS

Wellman Engineering Co, Cleveland, Ohio, manufacturers of materials handling equipment, has acquired the locomotive crane division and plant of Browning Crane & Shovel Co of Cleveland. Wellman will take possession in about 90 days. The plant will be known as the Wellman-Browning Locomotive Crane Division of the Wellman Engineering Co.

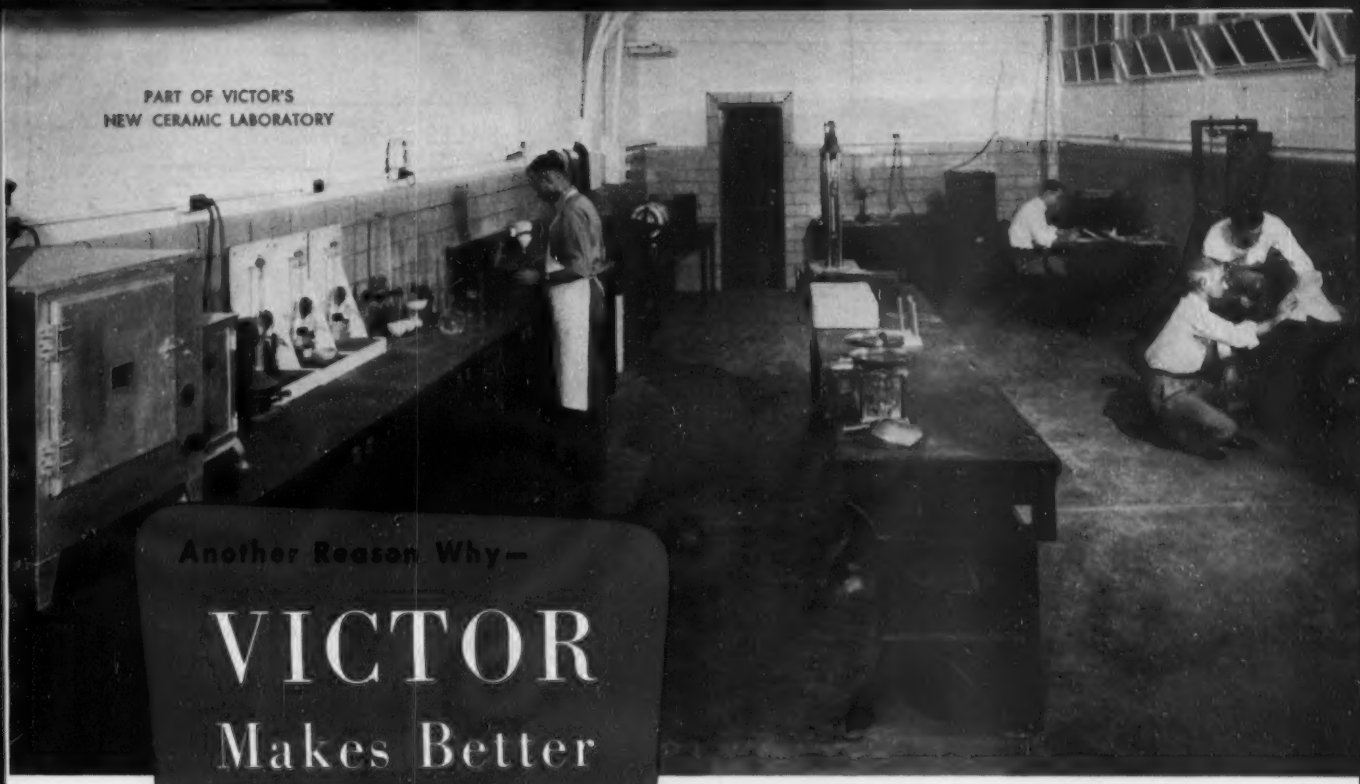
Du Pont will just about double its capacity for making "Teflon" at its Washington Works near Parkersburg, W. Va. The tetrafluoroethylene resin is used as insulation for motors, capacitors, and high-frequency cable.

Allis-Chalmers Manufacturing Co reports that sales invoiced for the first six months of this year will very closely approximate the $258-million volume for the same period of 1953.



Transformer Shipment Sets Record

The biggest shipment of identically rated substation transformers ever made by the General Electric Co from its Pittsfield, Mass., plant was made recently to a customer in the Middlewest. The 38-transformer shipment required six flat cars. Each transformer is rated 333 kva 67-7.2 kv, single phase, 60 cycle.



PART OF VICTOR'S
NEW CERAMIC LABORATORY

Another Reason Why—

VICTOR Makes Better Insulators

...WE CARRY ON

CONTINUOUS CERAMIC RESEARCH!

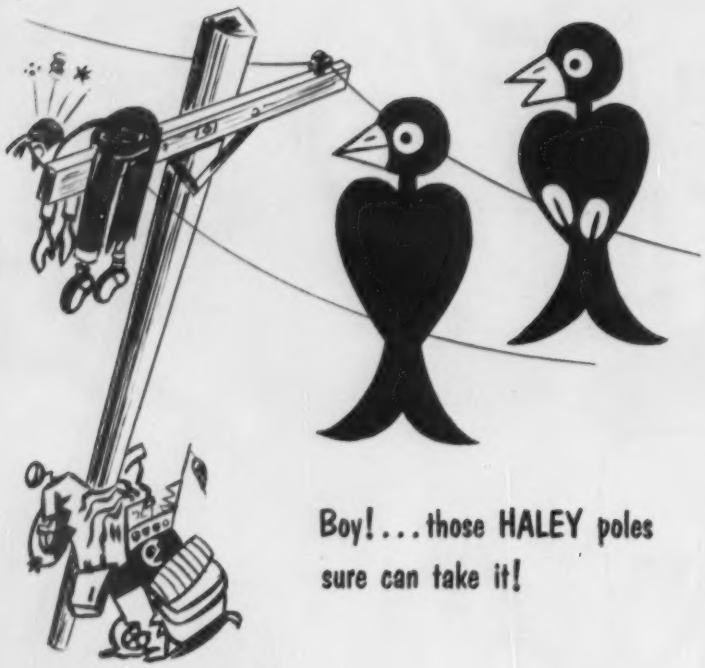
THE unequalled quality of VICTOR *Purified* Porcelain Insulators didn't just happen. It is the result of many years of research and experimentation in one of the industry's finest, most completely equipped ceramic laboratories. It is at VICTOR that many of the milestones in insulator progress such as infra-red drying, "black light" inspection and *Purified Porcelain* have originated. Because of VICTOR's continuing program of research, you can be sure that *IF* still better insulators can be made, they'll be VICTOR!

VICTOR NO. 924
25,000 LB. SUSPENSION
INSULATOR

Specify **VICTOR**
PURIFIED PORCELAIN INSULATORS!

VICTOR INSULATORS, INC., VICTOR, N. Y.

Low and High Voltage Pintypes • Suspensions • Guy Strains • Spools • Switch and Bus Insulators
• Custom Designed Porcelain • Insulator Hardware



Haley's PENTAchlorophenol TREATED

CEDAR POLES
AND
FIR CROSS ARMS

Light in weight and clean. PENTAchlorophenol treated in our modern plant for protection against decay, moisture and insect damage.

TWO Strategically Located Yards
MINNEAPOLIS, MINNESOTA
FINDLAY, OHIO

R. G. HALEY & CO.
SPITZER BLDG. TOLEDO 4, OHIO

SALES ASSIGNMENTS

COMPANY STAFFS

General Electric Co has made these appointments: Commercial Equipment Department, Syracuse, N. Y., appointed R. G. Clark to the newly created post of district sales manager for communication products in south central Texas with offices at San Antonio. Since joining GE in 1952, Clark has served as communications specialist with its New Orleans office. Construction Materials Division has assigned Howard M. McNeil as wire and cable specialist in its Central and Northwestern districts with offices in Denver . He formerly was a proposition engineer for GE's Wire and Cable Department at Bridgeport.

Allis-Chalmers Manufacturing Co's General Machinery Division has named S. M. Osthagen manager of its Providence, R. I., district office to succeed R. H. Porterfield, recently assigned to the Hartford district office as manager. Osthagen formerly was a representative in the firm's Boston district office.

Minneapolis-Honeywell Regulator Co has appointed two new branch managers and created a new district managership at Greensboro, N. C. Merritt Eusey, formerly head of Honeywell's Baltimore branch, was appointed head of the Pittsburgh office to replace Ray Weikel, who has assumed a supervisory position with the firm's Industrial Division in Philadelphia. Robert S. Warnick, formerly a supervisory commercial salesman in the Philadelphia office, succeeds Eusey at Baltimore. Donald H. Hannasch, a resident salesman at Rochester, Minn., was named to the newly created position of district manager at the Greensboro office, formerly under the direct supervision of the Charlotte office.

REPRESENTATIVES

Porcelain Products, Inc, Parkersburgh, W. Va., has appointed Southland Sales Agents, P. O. Box 165, Memphis 1, Tenn., as sales representative for its high voltage line in the western part of Tennessee and Arkansas. Manager of Southland Sales is Fred C. Todd.

Electrical Engineers Equipment Co, Melrose Park, Ill., has named K. H. Newbury Co, 1016 Nicolet St., Green Bay, Wis., as its sales representative for central Wisconsin and eastern upper Michigan.

Memco Engineering & Manufacturing Co, Inc, Commack, L. I., N. Y., has designated Fred R. Greene, 8905 Lake Ave., Cleveland 2, Ohio, as agent for its high voltage electrical equipment line in the state of Ohio.

Electric Controller & Manufacturing Co, Cleveland, has made Charles D. McCord & Son Engineering Sales, Lentz Rd., Largo, Fla., as agent for lifting magnets and motor starting and controlling equipment in Florida.

R. V. Palmquist, sales manager for the McGraw Electric Co's Clark Division and C. E. Whiteside, Midwestern district manager for the same company, have left the firm to form a manufacturers' representative organization in Des Moines, Iowa. Operations of the new organization will begin on or about August 1.

which of these feed-in duct features *rate highest with you?*

architects

rate these SQUARE D features particularly high:

lowest known voltage drop . . . maximum efficiency, minimum power loss

smallest cross-sectional area . . . conserves valuable installation space

contractors

give these features top billing:

reduced installation time . . . simplified components, factory prefabrication

new joint design (*lower right*) . . . all joint ends identical, connection bolts face outward

interchangeable standard fittings . . . permit horizontal or vertical riser applications

users

vote these SQUARE D features tops:

low cost installation and maintenance . . . most accessible connections

totally enclosed . . . permanent safety construction, excludes dust

completely reuseable . . . rearrangement with the same components

EXCLUSIVE JOINT DESIGN

SQUARE D's exclusive joint design saves installation time and reduces maintenance cost. Joint ends are identical—unnecessary to select mating ends before positioning or hanging duct sections. Outward-facing, pre-installed bolts permit rapid assembly and easy maintenance.

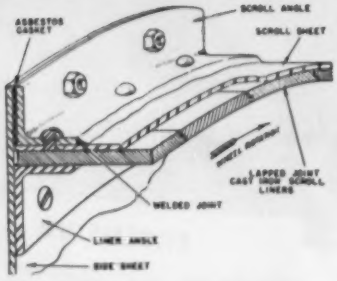
ASK YOUR ELECTRICAL DISTRIBUTOR FOR SQUARE D PRODUCTS

SQUARE D COMPANY

How a FAN HOUSING Helps Produce CHEAPER POWER

Here's a part of your power-producing equipment to watch, because it has so much to do with keeping your maintenance costs down and cutting draft timeouts to a minimum.

When you specify a "Buffalo" Induced Draft Fan, you get as rigid and heavy a housing as modern engineering can produce and still give you a highly efficient fan. You get a scroll shape that minimizes the powerful erosive action of hot fly-ash — with steel scroll liners to further delay erosion. These are easily replaced from inside or outside. All these "Buffalo" features combine to give these fans an extra margin of long life — in a "hot spot" where long fan life means big savings. And — many years later — when erosion finally necessitates repairs — "Buffalo" bolted sectional housing construction provides accessibility that shortens and simplifies the work.



Showing detail of "Buffalo" Removable Scroll Liner.

Naturally, all other parts of "Buffalo" Draft Fans are built of equally durable construction — rotors, shafts, bearings and inlet boxes. And the number of "Buffalo" Fans still carrying on after more than a quarter of a century, is proof of this endurance which means economy. Why not check "Buffalo" engineering by writing today for Bulletin 3750?

BUFFALO FORGE COMPANY
212 MORTIMER STREET BUFFALO 4, NEW YORK

Publishers of "Fan Engineering" Handbook

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.
Sales Representatives in all Principal Cities

"Buffalo"

PRESSURE BLOWING COOLING & HEATING FORCED DRAFT
VENTILATING AIR CLEANING AIR TEMPERING INDUCED DRAFT EXHAUSTING

MEETINGS CALENDAR

Pan-American Federation of Engineering Societies
(UPADI), Third Convention, Sao Paulo, Brazil, Aug. 2-12.

Southeastern Electric Exchange
Personnel Administration Section, Grove Park Inn, Asheville, N. C., Aug. 19-20; Engineering and Operation Section, Thomas Jefferson Hotel, Birmingham, Ala., Sept. 23-24; Accounting Section, Roanoke Hotel, Roanoke, Va., Oct. 28-29; General Sales Conference, Roosevelt Hotel, New Orleans, La., Oct. 28-30; Employee and Public Information Section, Roosevelt Hotel, New Orleans, La., Oct. 28.

International Electrotechnical Commission
50th Anniversary Meeting, University of Pennsylvania, Philadelphia, Sept. 1-16.

American Society of Mechanical Engineers
Fall Meeting, Schroeder Hotel, Milwaukee, Sept. 8-10; Annual Meeting, Statler Hotel, New York, Nov. 28-Dec. 3.

Rocky Mountain Electrical League
Annual Fall Convention, Stanley Hotel, Estes Park, Colo., Sept. 12-15.

Illuminating Engineering Society
National Technical Conference, Chalfonte-Haddon Hall, Atlantic City, N. J., Sept. 12-16.

Public Utilities Association of Virginias
36th Annual Meeting, The Greenbrier, White Sulphur Springs, W. Va., Sept. 16-18.

Edison Electric Institute
Accident Prevention Committee, Benjamin Franklin Hotel, Philadelphia, Sept. 20-21; Industrial Relations Committee, Round Table Conference, Palmer House, Chicago, Sept. 27-29; Prime Movers Committee, De Witt Clinton Hotel, Albany, N. Y., Oct. 4-5; Electrical Equipment Committee, Hotel Statler, Hartford, Conn., Oct. 11-12; Prime Movers Committee, Astor Hotel, New York, Nov. 29-30.

American Institute of Electrical Engineers
Committee on Petroleum, Conference on Electrical Applications in Petroleum Industry, Mayo Hotel, Tulsa, Okla., Sept. 27-29; Middle Eastern District Meeting, Abraham Lincoln Hotel, Reading, Pa., Oct. 5-7; Fall General Meeting, Morrison Hotel, Chicago, Oct. 11-15.

National Electronics Conference
10 Annual Conference, Hotel Sherman, Chicago, Oct. 4-6.

National Association of Electrical Distributors
Pacific Zone Convention, Mark Hopkins Hotel, San Francisco, Oct. 4-7.

Indiana Electrical Association
Annual Convention, French Lick Springs Hotel, French Lick, Ind., Oct. 6-8.

Interstate Power Club
Meetings will be held at Hotel Martinique, New York, on following dates: Oct. 11, Dec. 6.

***Pennsylvania Electric Association**
Fall Meeting, Systems Operation Committee, Alexander Hotel, Hagerstown, Md., Oct. 7-8; Fall Meeting, Electrical Equipment Committee, Hotel Robert Treat, Newark, N. J., Oct. 19-20.

***Oklahoma Utilities Association**
Electric Light & Power Division, Western District, Oct. 21; Eastern District, Oct. 22.

Public Information Program
Workshop Conference, Chase Park Plaza Hotel, St. Louis, Oct. 28-29.

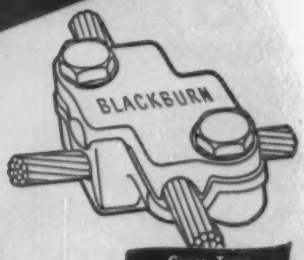
National Electrical Manufacturers Association
Haddon Hall Hotel, Atlantic City, N. J., Nov. 8-11.

American Standards Association
36th Annual Meeting and 5th National Conference on Standards, Hotel Roosevelt, New York, Nov. 15-17.

*Addition this week.

You can handle a wide variety of jobs with this

Stronger, More Versatile BLACKBURN *Cross Tap* CLAMP



Cross Taps

T Connections

Parallel Connections

End to End Connections

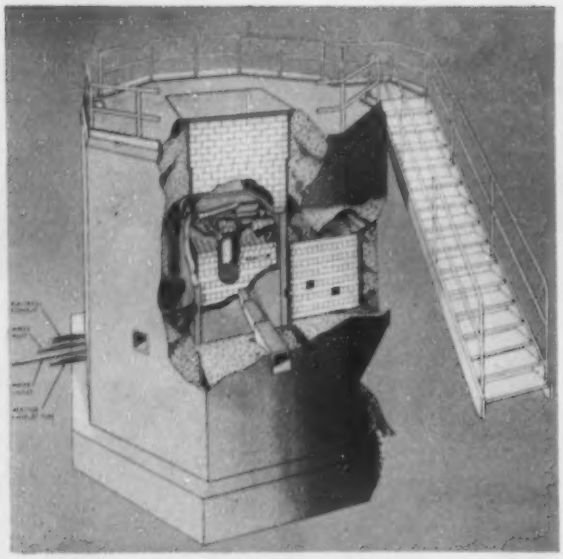
Get quick service for a large number of different connection and wiring jobs with BLACKBURN'S Cross Tap Clamp.

- **Eight connectors accommodate cable sizes from #6 to 1000 MCM.**
- **Made of high strength copper alloy; silicon bronze bolts; phosphor bronze shakeproof lockwashers.**
- **Rounded edges for easy taping.**
- **Greater wrench rotation with either end or socket type speeds installation.**
- **Available from Electrical Distributors everywhere.**

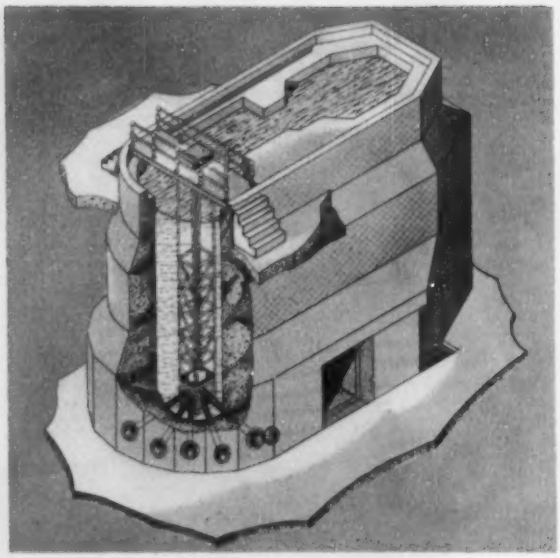
Also available completely tin plated for general purpose work.

JASPER BLACKBURN CORPORATION

35 Madison Street • St. Louis 6, Missouri • Phone MAin 1-2821



"Water Boiler" Reactor



"Swimming Pool" Reactor

Two Low-Cost Atomic Reactors

Two relatively low-cost atomic reactors have been designed to conduct basic nuclear research and development, and are adaptable for use in training personnel for the nuclear power industry. The designs are modified versions of the declassified "water boiler" and "swimming pool" reactors developed at installations of the Atomic Energy Commission.

"Water Boiler" Reactor . . . This type reactor has an over-all design similar to the Los Alamos "water boiler." It is a semi-homogeneous unit comprising a solution of enriched uranium sulfate in water as fuel and moderator, and a separate cooling system. Rated power is from 200 to 400 kw, but the unit can be operated at any power below this level.

The uranium sulfate solution is contained in the lower half of a cylindrical vessel with spherical bottom. The vessel is 10 in. ID by 3 ft high. The $\frac{1}{16}$-in. thick shell is Type 347 stainless steel. Boron control and safety rods extend down into the core (solution) from above. Core is located in the center of an approximately 4-ft cube of graphite reflector which, in turn, is surrounded by a 4-in. carbon steel thermal shield. A 5-ft extension of the graphite reflector on one side serves as a thermal column.

Pressure above the fuel solution is maintained at negative 6 in. of water as a safety feature in order that any leakage will be into the reactor gas system rather than out into the reactor room. Hydrogen and oxygen gases created by fission-induced dissociation of the water in the fuel solution are diluted with helium to keep the concentration well below the danger point and are then recombined in a catalyst bed and returned through a closed loop to the core.

Cooling system comprises U-shaped Type 347 stainless steel cooling tubes placed so that they dip down into all parts of the fuel solution and maintain the fuel temperature at a constant level below the boiling point. The coolant is ordinary water.

The reactor and its components are contained in an octagonal, high density concrete shield. Aluminum exposure ports extend to the core or reflector from all shield faces, and two ports are located in the thermal column. The air space within the shield is maintained at a slightly negative pressure as a secondary safety feature.

Introduction of more cooling capacity permits operation at higher power and production of a higher thermal flux than can be achieved with an ordinary water boiler. Total flux density of the unit is about 10^{13}n/cm^2/sec. The unit has been designed for high specific power and high thermal flux. The total power and therefore the critical mass is nevertheless relatively low compared to other types of reactors.

"Swimming Pool" Reactor . . . This reactor is a modified version of the Oak Ridge bulk shielding facility reactor. Its maximum power is about 1,000 kw. The core is heterogeneous, with a minimum critical mass of 2.75 kilograms. The pool is approximately 10 ft wide by 20 ft long by 25 ft deep, and is ordinarily equipped with eight 6-in. and two 8-in. beam ports. The shield is constructed of high density concrete.

The unit can be operated with a variety of core patterns with or without a partial or full reflector of graphite or BeO. Control is accomplished by rods integrated with the core suspension and actuated by a simplified drive mechanism. Instrumentation has also been simplified.

In addition to its standard beam ports, the swimming pool reactor usually incorporates three pneumatic tubes

HUBBARD-COPPERWELD drive-head ground rods

APPROXIMATE PROPORTION OF COPPER AND STEEL IN HUBBARD-COPPERWELD ROD

Those who have tried the Hubbard-Copperweld drive-head type of ground rod are enthusiastic about its convenient built-in clamp. This exclusive Hubbard product simplifies inventory, eliminates confusion, saves time.

The top of the rod is designed to prevent damage in driving, and even if careless driving does batter the end, the clamp is already in place and no problem is created. The Hubbard-Copperweld Drive-Head Ground Rod has the well known features of permanent low cost grounding of the regular Hubbard-Copperweld line, coupled with the added convenience of the integral clamp.

The Hubbard-Copperweld Drive-Head Ground Rod is furnished in 5/8 and 3/4-inch diameters and in lengths from 5 to 12-feet. Extra lengths are available on special order.

Write for descriptive literature.

HUBBARD AND COMPANY

PITTSBURGH • CHICAGO • OAKLAND, CALIFORNIA

"Hang the load on Hubbard Hardware!"

for fast "rabbit" experiments. Provision is made for inclusion of special ports and experimental tubes in a number of different arrangements.

At full power, the core is cooled by recirculating pool water through a heat exchanger at the rate of 1,000 gpm. The pool water is continuously deionized to prevent build up of radioactivity and, in the event of a power failure, the inlet header will automatically disengage to permit natural convection cooling.

Babcock & Wilcox Co, Atomic Energy Division, 161 East 42nd St, New York, N. Y.

Underground Cable

A new Type UF underground feeder cable derives its corrosive resistance characteristics from thermoplastic insulation. On the multi-conductor cables, a fiber glass wrap separates the individual conductor insulation from the cable jacket. This is said to add strength and make stripping easier.

The cable is available with single conductor in sizes No. 14 to 4, and with two and three conductors in sizes No. 14 to 10, solid or stranded. It is also recognized for use as Type NMC, non-metallic sheathed cable, corrosive resistant.

Type UF cable can be buried directly in the ground, snaked inside masonry block walls, inbedded in plaster or in a shallow chase in masonry block walls when provided with adequate mechanical protection, or used for exposed or concealed wiring in dry, wet or corrosive locations.

Triangle Conduit & Cable Co, Inc, New Brunswick, N. J.

Enclosed Cutout

Indicating cutout is rated 100 amp, 5.2 kv, with interrupting capacity of 8000 amp at 2.5 kv and 5000 amp at 5.2 kv. This Type PIV (Porcelain, Intermediate Duty, Vertical Dropdown) is a box-type cutout with a dropdown tube to provide visual indication of cutout operation and to disconnect the fuse tube from the circuit.

The PIV cutout is claimed smaller and cheaper than units previously considered standard for its rating. The box will accommodate standard 50-amp door and cartridge assemblies, the PID indicating 100-amp door, and a 200-amp, solid-blade disconnect switch door.

Line Material Co, 700 W. Michigan St, Milwaukee 1, Wis.

Cross Tap Clamp

Versatile cross tap clamp will join different combinations of cable sizes. The cross tap connector is made of high strength copper alloy. It has silicon-bronze bolts and phosphor-bronze shakeproof lockwashers.

Greater rotation with either end or socket wrench speeds installation. All edges are rounded for easy taping. Eight connectors accommodate cable sizes from 6 AWG to 1,000 Mcm. Bulletin XT.

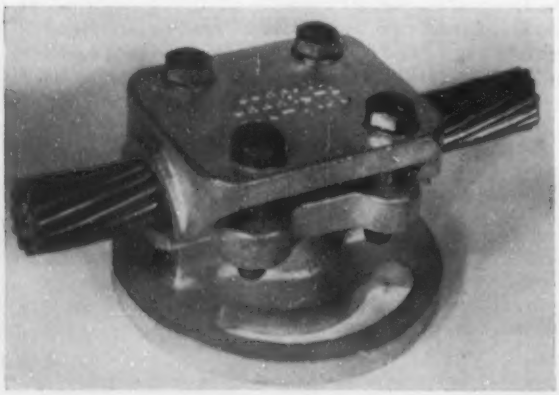
Jasper Blackburn Corp, 35 Madison St, St. Louis 6, Mo.

Taping Gun

Electrical harness wrapping can be speeded up reportedly from 2 to 10 times by using plastic tape dispensed by a new "taping gun". Known as the "Scotch" taping gun, Model E-2, it is specifically designed for ⅜-in.

wide "Scotch" plastic electrical tape No. 33. The gun with 36-yd roll of tape in circular magazine weighs less than 20 oz.

The slender, 10.5-in., curved tip



Bus Clamp

Range-taking bus support clamp accommodates either cable or tube on indoor or outdoor substation insulators. Designated Type UHKR, the all-bronze constructed unit has kidney slots in its base to permit angular adjustment. Durium bronze hardware is provided to develop constant high clamping pressures and assure low contact resistance. Range of sizes are: No. 6 stranded cable and ½-in. IPS tube; No. 4/0 stranded cable and 1 in. IPS tube; 750 Mcm cable and 1½ in. IPS tube.

Burndy Engineering Co, Norwalk, Conn.

ALL FARGO CONNECTORS* are "VISE-TYPE"

Ask your Line Material Field Engineer for complete details.

FARGO

Manufactured by
FARGO MFG. COMPANY, INC.
Poughkeepsie, N. Y.

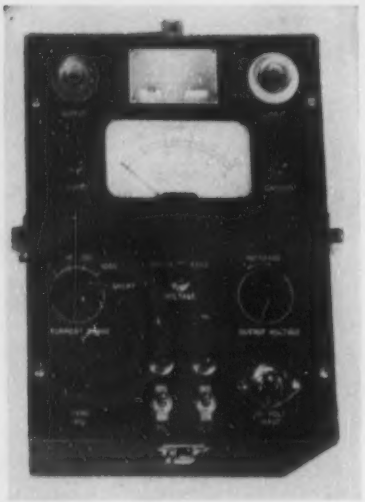
Distributed by
LINE MATERIAL COMPANY
(A McGraw Electric Company Division)
Milwaukee, Wisconsin

LM

* Patented

serves as a "needle" to thread the tape around wires on a cable layout board. The operation to bundle the wires and cut the tape in a single motion is said to take about one second.

Minnesota Mining and Mfg Co, 900 Fauquier St, St. Paul 6, Minn.



Insulation Test Set

Insulation test set, TAKK Model 53, combines in one small instrument, weighing 15 lb, a 5000-v dc power supply and a sensitive current meter. Each may be used independently. It will measure current down to 0.002 ua and resistance up to 5 million megohms.

Instrument provides voltage range from 0 to 5,000 v (continuous, variable) and 5 current ranges from 0-0.1 to 0-1,000 mu a. This test set is used as a preventive maintenance tool on all types of low voltage electrical apparatus to give warning of weaknesses or defects in insulation before actual breakdown occurs. Input is 110-120 v ac. Details in Bulletin 54-105.

Hewson Company, Inc, 443 Broad St, Newark 2, N. J.

Carbon-Pile Rheostat

Compact, carbon-pile rheostats are built of rectangular carbon plates formed in a single pile and housed in a one-piece steel box. They are rated 25-250 amp on continuous service—higher for intermittent loads. Resist-

ance changes range as high as 50 to 1. Rheostats are designed for electroplating installations, general testing work, or other low-voltage, high-current applications where stepless control is desired.

Hanson-Van Winkle-Munning Co, Matawan, N. J.

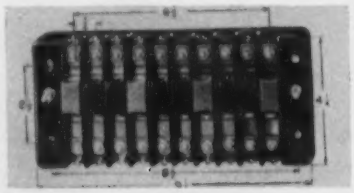
Drum Switch

Reversing drum switch, Bulletin 905, is suitable for use with conveyors, hoists, wood and metal working machinery, machine tools, pumps, and processing equipment. Maximum ratings are: 2 hp, 230 v, single-phase; 2 hp, 550 v, 2 and 3-phase; ¼ hp, 115 and 230 v, dc.

Contacts are double-break silver. They are closed by straight-line action to increase interrupting capacity and reported to eliminate sliding or teasing and resultant wear.

Sheet steel enclosure is Type A (NEMA Type 1) with a U-shaped cover. Mounting holes are on bottom and back. Operating handle may be changed to operate from the front, back or either side.

Federal Electric Products Co, 50 Paris St, Newark, N. J.



Meter Test Switch

The Tesco test switch operates on the principle of fixed contacts and a sliding link. A low contact resistance is assured by a non-adjustable heavy spring. Base of switch is a one-piece plastic molding with thick barriers between circuits.

Plastic molded cover can be put on the test switch only when all knobs are pushed up into the normally closed or operating position. Switch can be assembled with current and potential switches in any desired arrangement up to a maximum of 10. Switch measures 2¼ x 9⅞ x 5 in. It is rated 600 v, 50 amp. Details in Bulletin 48.

Eastern Specialty Co, 3617 N. 8th St, Philadelphia 40, Pa.

Solenoid Valves

A new line of cylinder-operated solenoid pilot controlled valves (Bulletin 8338) for handling corrosive gases and liquids are suitable for either normally open or normally closed operation. Body material, such as bronze, steel, and various alloys, may be selected for the gas or liquid to be handled. Solenoid operates an air, water or oil-operated cyclinder which in turn operates the valve. Standard, watertight or explosion-proof solenoid enclosures available.

Automatic Switch Co, 391 Lakeside Ave, Orange, N. J.

MORE NEW PRODUCTS

about which you should know

Sun Chemical Corp, Long Island City, N. Y., has Bi-Glas high-temperature Class B **insulating material** which will withstand hot-spots up to 150C. Made of bias-woven Fibreglas cloth treated with high-temperature varnish, it is available in full-width or tape form.

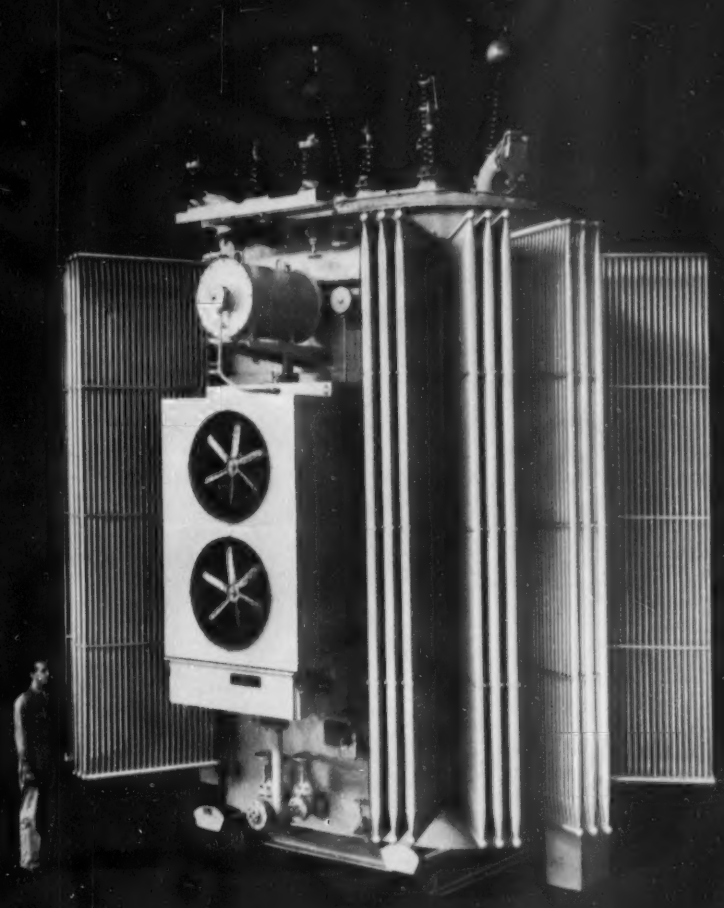
Hastings Instrument Co, Inc, Warwick, Va., has panel-mounted **vacuum gauge** for 1-1,000 microns Hg using directly heated thermocouples, measures 7 x 7½ x 2¼ in., weighs 3½ lb.

International Rectifier Corp, El Segundo, Calif., has selenium **photoelectric cell,** B2M, measuring 23/32 x 7/16 in., 0.26 sq. in. active area, generates 60 microamp at 100 ft-c (Bulletin ER-205).

International Harvester Co, 180 N. Michigan Ave, Chicago 1, Ill., has **right-hand drive trucks** for domestic delivery in light, medium, and heavy-duty fields. Uses include roadside spraying. Right-hand drive is available on trucks with conventional cab design built at Fort Wayne, Ind, and Springfield, O., (except diesel models).

41,667 KVA SINGLE PHASE

PENNSYLVANIA POWER TRANSFORMER



Seven of these Pennsylvania power transformers are installed in two 125,000 Kva banks, with one unit serving as a spare. The transformers are designed to step down a transmission voltage of 110,000 volts. Each transformer has a capacity of 41,667 Kva when both forced-oil—forced-air heat exchangers are in operation. When only one of the heat exchangers is used, each transformer can be loaded to 33,333 Kva. Self-cooled, each transformer has a rating of 25,000 Kva.

Low Voltage windings are wound in two sections — each equal to one-half the rating of the High Voltage windings — and brought out through separate bushings.

See next page for inside story

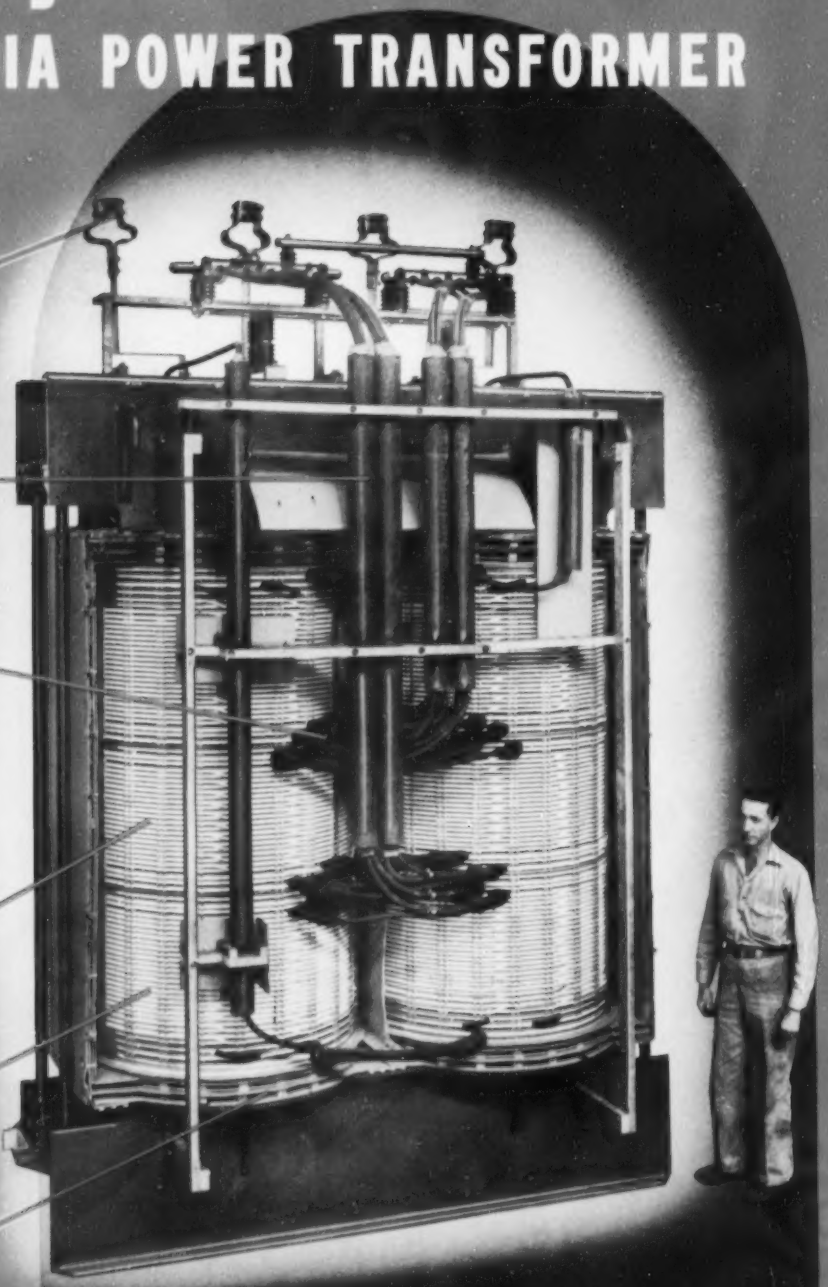
pt

PENNSYLVANIA TRANSFORMER COMPANY

A McGraw Electric Company Division

CANONSBURG, PENNSYLVANIA • *Greater Pittsburgh District*

Inside a 41,667 KVA, single phase PENNSYLVANIA POWER TRANSFORMER



Flexible Low Voltage bushing connectors.

Well-insulated tap leads, rigidly supported, are connected to Pennsylvania straight line no-load tap changers.

Two sets of taps per coil assure excellent electrical and mechanical balance in the windings.

Coils are precompressed with force equal to the highest short circuit stress and built into the transformer at that compressed dimension. This prevents mechanical distortion of the coils if short circuit stresses occur.

Continuous pancake winding in High Voltage coils. Helical winding in Low Voltage coils.

Extra heavy insulation at line ends of coils. Graded insulation at ground ends of coils.

pt

For exterior view of this transformer, see other side.

25,000/33,333/41,667 Kva. Single Phase, 60 Cycles, 55 C. Temperature rise. High Voltage: 110,000 volts. Low voltage: 7,950/13,800 volts.

PENNSYLVANIA TRANSFORMER COMPANY

A McGraw Electric Company Division

CANONSBURG, PA. *Greater Pittsburgh District*

BOOKS

Received Since June 25

Elektrizitaetszaehler — Tarifgeraete, Messwandler, Time-Switches. By P. M. Pflier. Published by Springer-Verlag, Reichpietschufer 20, Berlin W 35. 368 pages, illustrated. Price 36DM

Linear Transient Analysis, Vol. I. By Ernst Weber. Published by John Wiley & Sons, Inc, New York 16. 348 pages. Price $7.50

Electronics for Everyone. By Monroe Upton. Published by The Devin-Adair Co, New York 10. 370 pages, illustrated. Price $6.00

The Insulation of Electrical Equipment. Edited by Willis Jackson. Published by John Wiley & Sons, Inc, New York 16. 340 pages, illustrated. Price $7.75

Electrical Transients. By L. A. Ware and G. R. Town. Published by The McMillan Co, New York 11. 222 pages. Price $4.75

Electron Tube Data

Data and Circuits of Television Receiver Valves. By J. Jager. Distributed by Elsevier Press, Inc., Houston 6, Tex., and New York 28, N. Y. 226 pages, illustrated. Price $4.50.

This book is III C in the Electronic Valves series of Philips Technical Library. It pertains particularly to recent tubes created for television receivers, including complete data for each type and the circuit in which it is used. Following this comes description of recent receiver circuits.

Primary interest in this book is as reference material for Philips vacuum tubes. But utility engineers concerned with television circuits for remote observation of generating equipment, or with eliminating TVI, might benefit by its logical presentation.

Materials and Processes

Materials and Processes (2nd Edition). By James F. Young. Published by John Wiley & Sons, Inc, New York 16, N. Y. 1059 pages, illustrated. Price $8.50.

In this second edition the primary objective of the first edition was maintained to present in one volume the interrelated information needed to apply engineering fundamentals of metallic and non-metallic materials and processes to the design, production and control of products. New chapters have been added on metallographic examination, structure and properties of non-metallic materials, and statistical methods— useful in quality control. Sections have been added on tarnishing, electric contacts, and non-destructive testing. The chapter on heat-treatment has been revised and consolidated with chapters on ferrous metals. And coverage has been expanded on subjects such as bearing metals, blow molding, shell molding and pressure welding. This book can serve as a reference for specific topics or can be used to review the entire subject of materials and processes.

CATALOGS • BULLETINS

COMPRESSOR: Form 3155, 4 pages, covers PHE packaged air compressor, 75-100 hp, 80-125 psi. Ingersoll-Rand, 11 Broadway, New York 4, N. Y.

PLATFORM TRUCK: A 4-page folder, Form B-88, covers a low-lift platform electric truck with 4-wheel steering, Model EP4-11, 4,000-lb capacity. Elwell-Parker Electric Co, 4205 St. Clair Ave, Cleveland 3, Ohio.

PHOTOELECTRIC LIGHT SWITCH: Catalog sheet covers Model 6501 photoelectronic automatic light switch which turns lights on at dusk, off at dawn; 110 v 6 cps; will control 300-w loads; weighs 20 oz. Fisher-Pierce Co, Inc, South Braintree, Boston 85, Mass.

● **RECORDER:** Bulletin 1570, 4 pages, describes the Multi-Point Logger System. Strip-chart recorder measures and records variables from 144 different points. Minneapolis-Honeywell Regulator Co, Wayne & Windrim Ave, Philadelphia 44.

● **ACCELEROMETERS:** Bulletin AL-1, 4 pages, covers linear accelerometers, various ranges between 0.5 and 200g, unbonded strain-gage type. Statham Laboratories, Inc, 12401 W. Olympic Blvd, Los Angeles 64, Calif.

● **TEMPERATURE INDICATOR:** Leaflet (Form 196) describes temperature indicating instruments, 6 types, each with span of 130 F in six ranges, or a single range of 30 F, thermistor-battery-meter type. Beckman & Whitley, Inc, 985 San Carlos Ave, San Carlos, Calif.

● **INSTRUMENT GENERATOR:** Leaflet (Form GPM-44A) describes a 9-oz, permanent-magnet, continuous-duty generator used as precision voltage source: 1,200 rpm 20 cps, 2,100 rpm 35 cps, 4,500 rpm 75 cps; 2-phase; 75 v at 4,500 rpm; 450 ohms winding resistance per phase; 30,000 ohms load resistance per phase. Generator is used for instrument indicating and similar uses. Dalmotor Co, 1389 Clay St, Santa Clara, Calif.

● **TACHOMETER:** A 1-page bulletin (765) describes double-range Model JX hand tachometer with stop button to hold readings. It is centrifugal-mechanical type, 50-5,000 rpm, 25-2,500 fpm. Herman H. Sticht Co, Inc, 27 Park Pl, New York, N. Y.

● **RECORDING SYSTEMS:** Revised 1954 catalog has 18 catalog sheets in index folder, and covers oscillographic recording systems, 1, 2, 3, 4 channel, amplifiers, monitors, etc. Sanborn Co, Industrial Div, Cambridge 39, Mass.

● **LUMINOUS CEILINGS:** Five leaflets show use of luminous ceilings in drafting rooms, airline offices, stores, offices, and banks. Luminuos Ceilings Inc, 2500 W. North Ave, Chicago 47, Ill.

THIEL
TRANSFORMER HANGERS

Heavy-gauge steel construction, hot-dip galvanized for long life. Designed to NEMA specifications. Furnished with galvanized bolts and nuts.

MODEL C-1
for 75-100 KVA 1-Phase

MODEL C-3
for 75-112½ KVA 3-Phase

IN STOCK

T-TYPE HANGERS
in two sizes. For 3-50 KVA 1-Phase and 9-45 KVA 3-Phase transformers.

HANGER KICKERS
In sizes to fit T-type hangers.

THIEL TOOL AND ENGINEERING CO.
1417 No. Market St. • St. Louis 6, Mo.

STRENGTH, ENDURANCE that Meet the Test!

Crapo
Guy and Messenger Strand

IN THE FIELD as in laboratory tests . . . *Crapo* Galvanized Steel Strand proves itself capable of withstanding severe punishment. Steel's inherent strength and durability are combined with definite economies in every size and grade of *Crapo* Steel Strand. You'll find the heavy, ductile, tightly-bonded zinc coatings, applied by the famous *Crapo* Galvanizing Process, provide lasting protection against corrosion.

Contact your jobber of *Crapo* Galvanized Products or write direct for further information!

INDIANA
STEEL & WIRE COMPANY
MUNCIE, INDIANA

INDUSTRIAL APPLICATIONS

Electronic Printers Improve Photos And Save Time

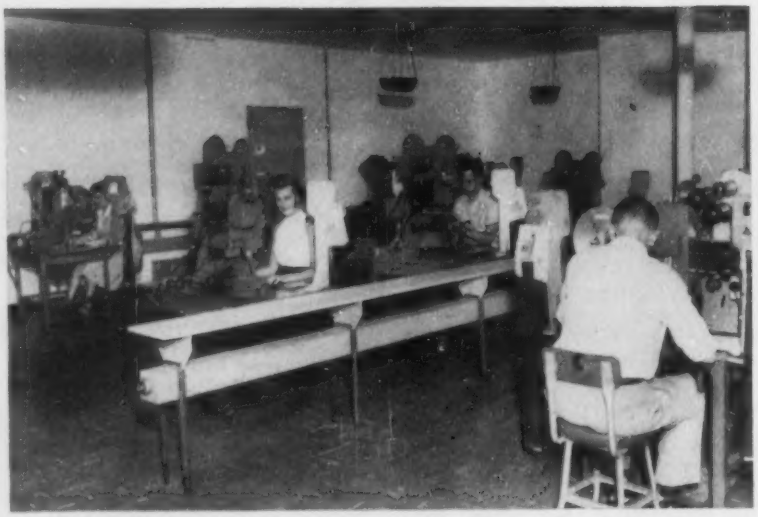
L. ALBERTSON Philadelphia Electric Co
Philadelphia, Pa.

A battery of 16 electronic printers at Perfect Photo Service, Philadelphia, Pa. helps improve quality of prints, saves time and reduces spoilage. These printers do a unique job in timing the transmission of light through films to sensitized paper in the process of printing. The printers are operated in the darkroom.

In the plant, reported to be one of the most modern in the world, electricity powers two machines in which progressive steps of developing, rinsing, and fixing are automatic, and accurately timed. It operates conveyors in a drying room where racks of film are passed through lanes of infrared heaters while small fans create an air movement to drive off moisture.

An electric sealing unit is used on a machine in the darkroom which processes paper after the image is put on it. Sealing one strip of paper quickly to another to continue the supply of paper prints, or sealing it to a threader at the start of the machine, is a real time saver. Prints are taken from this machine to the finishing room and run through electrically heated dryers.

There are seven driers in the group and each contains a 5,000-w heating unit. Prints dry on one revolution of the large drum. Advantages are speed and uniformity. Hoods over the units and a carefully planned electric ventilating system trap and carry off excess heat so that it will not materially affect the efficiency of the air conditioning.



ACCURATE CONTROL of light being passed through film to place images on rolls of sensitized paper is done in darkroom by battery of 16 electronic printers. Wide versatility of printers improve operator's skill to obtain highest quality prints without loss of time

Molded Parts Cleaned Better and Faster With Apricot Pits

Cleaning excess or "flash" left on plastic parts after molding in a Wheelabrator machine at Federal Electric Products Co, Newark, N. J., turns out 800 finished pieces every 2½ min. There is no damage or marring of the surfaces and breakage has been cut to one percent. Previously, a maximum of 2,500 pieces a day could be finished by hand methods.

The plastic molded parts and circuit breaker cases are placed in the machine which propels granulated apricot pits at them. The machine accommodates parts ranging from ½-in. thick circuit breaker cases to large 10-in. by 12-in. molded blocks for fusible service equipment. Belt drive on machine is 1 hp and blast compressor is 10 hp.

WHEELABRATOR machine propels apricot pits at molded plastic parts

As never before...

Today we are all aware of the disastrous and far-reaching effects of a major industrial fire. Owners . . . management . . . employees . . . customers . . . almost every one suffers, in one way or another, when a serious fire strikes.

Could it happen to your plant? Now is the time to take a long, close look at your plant's fire protection measures. Remember, the local fire protection ordinances normally only set minimum standards. Compliance with these ordinances is no guarantee of fully adequate firesafety.

One way to be absolutely sure of the efficiency of your plant's fire protection facilities is to call in an expert C-O-TWO Fire Protection Engineer. He is ready and willing to help you with any or all industrial fire hazard problems.

There is a personal sense of responsibility inherent with C-O-TWO Fire Protection Engineers that assures you of fully adequate firesafety . . . a definite plus in your behalf. Whether it's fire detecting or fire extinguishing . . . portables or built-in systems . . . C-O-TWO means top quality backed by experienced engineering that results in operating superiority for you at all times.

WHEN BUSINESS STOPS . . . INCOME STOPS!

Don't take chances with your investment. Secure the benefits of highly efficient fire protection engineering today . . . our extensive experience over the years is at your disposal without obligation. Get the facts now!

C-O-TWO

MANUFACTURERS OF APPROVED FIRE PROTECTION EQUIPMENT

Squeez-Grip Carbon Dioxide Type Fire Extinguishers
Dry Chemical Type Fire Extinguishers
Built-In High Pressure and Low Pressure Carbon Dioxide Type Fire Extinguishing Systems
Built-In Smoke and Heat Fire Detecting Systems

C-O-TWO FIRE EQUIPMENT COMPANY
NEWARK 1 • NEW JERSEY

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Sales and Service in the Principal Cities of United States and Canada

AFFILIATED WITH PYRENE MANUFACTURING COMPANY

LIGHTING INNOVATION in a plant that fabricates aluminum and stainless steel provides high-intensity, minimum-glare illumination. Initial intensities ranged from 100 to 130 ft-c, while maintained level is 75-100 ft-c. The 277/480-v distribution system cut first costs

Plant Combines Fluorescent and Mercury

C. C. CLARDY Staff Assistant Plant Engineering Rohr Aircraft Corp, Chula Vista, Calif.

A combination of fluorescent and mercury luminaires in the new Riverside factory of Rohr Aircraft Corp, Chula Vista, Calif., provides top quality lighting with substantial savings in cost. Use of the 277/480-v distribution system and plug-in duct eliminates duplicate transformer equipment and long feeders to panels and means considerable savings in copper for branch circuits.

Lighting for this factory, which fabricates sheet aluminum and stainless steel, posed a difficult problem. Because of the bright reflective surfaces of the metals, light sources were required that would minimize reflected glare. At the same time, high intensity was needed so that scribed lines on the metal sheets could be seen easily. The plant is 250 ft wide and 800 ft long with roof trusses 20 ft high.

To meet these needs, a lighting ratio of 20% fluorescent and 80% mercury was used. Fluorescent lamps were chosen over incandescent because of their adaptability to 277 v and their longer life. By following a pattern conforming to the roof trusses, uniform rectangular spacing of 10x12½ ft is provided for the luminaires. Mercury luminaires are duplex units with prismatic glass and hold two 400-w lamps. A standard RLM steel porcelain-enameled 60-in. unit holds two 85-w fluorescent lamps.

Four mercury and four fluorescent luminaires alternate on each lighting circuit for a total load of slightly over 4 kw per circuit. There are 782 fixtures of each kind and a total of 3,128 lamps. A level of 75 to 100 ft-c is the maintained design intensity.

Power for lighting and all operations except spot welding is supplied by two 1,000-kw unit substations. Each is located near the center of each half of the building. By taking power directly from feeders and using 277/480-v, 4-wire distribution, extra substations and heavy feeders were eliminated. Each substation feeds two 200-ft plug-in ducts rated 800 amp 480/277 v, 4-wire. This gives the equivalent of one duct running the entire 800-ft length of the building.

For mechanical strength, Unistrut is used for support of the luminaires and wire-way in all circuits. This eliminates the need for many hanger supports from the roof. It contains two No. 12 conductors and averages 100 ft long.

Light controlling switches are Size 1 combination 480-v, 3-phase starters with 480/110-v control transformer. The switches have 20-amp current limiting fuses but no overload relays.

The small amount of local office or desk lighting and the hundreds of small electric drills and hand tools are supplied at 110 v. Five banks of 45-kva, 440-120/208-v, 4-wire dry-type transformers are strategically located in the plant.

INDUSTRIAL BRIEFS

High bay lighting of new addition to Card Iron Works, Denver, Colo., with a combination of mercury vapor and incandescent lamps in high bay aluminum reflectors provides 30 ft-c of color-corrected illumination on working plane. Stroboscopic effect of the mercury vapor units is minimized and hazard of rotating machinery considerably reduced. Alternate units are connected to alternate phases of 3 phase supply to further reduce "strobe" effect by "overlapping" of ignition and extinguishing arcs of adjacent mercury vapor lamps. Each 16 by 21-ft bay has a 400-w, 16,000-lumen, AH-1 mercury vapor lamp unit together with a 500-w, PS-40 incandescent lamp unit. Fred R. Leffler, Electrical Design Engineer, Weers Electrical Planning Service, Denver, Colo.

Degreasing metal strips for window screens at Atkinson Industries, Orwigsburg, Pa., with 2-kw infrared lamp bank, eliminates tendency of strips to cling together—thus retarding production. Operation is simplified without costly degreasing equipment installation. Company is well pleased with application and is benefiting from increased production and correction of a troublesome operation. Vincent Smith, Industrial Representative, Pennsylvania Power & Light Co, Pottsville, Pa.

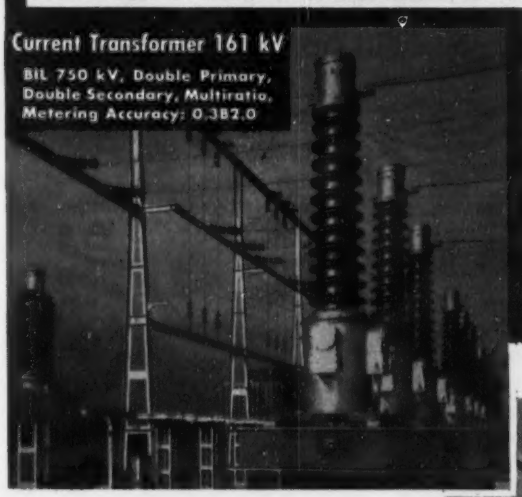
Pre-heating oil for oil-fired boiler with electric pre-heater at L. B. Cavett Co, Lockland, Ohio, permits rapid starting of 150-hp oil-fired steam boiler and generating steam at 150 psi. The steam is used for melting asphalt, tar, and similar materials. The electric pre-heater maintains closer temperature control than is possible by any other means. The preheater consists of a cylindrical steel tank of approximately 8-gal capacity with inlet and outlet oil piping connections and with machined surfaces at either end. At one end of tank, a 5000-w, 230-v, single-phase, resistance type immersion heater is mounted and bolted to the machined surface. At other end of tank is mounted the thermostat which is set to limit temperature of oil to 180 F. L. J. Langevin, Power Engineer, Cincinnati Gas & Electric Co.

BROWN BOVERI

High Voltage, Insulation-type, Oil-filled

INSTRUMENT TRANSFORMERS

conform to prevailing ASA standards C57.13

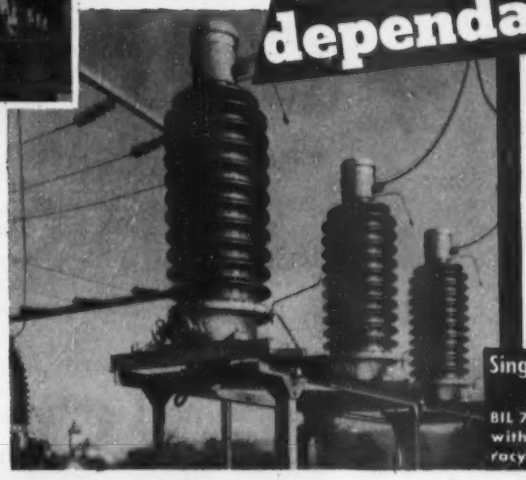


Current Transformer 161 kV
BIL 750 kV, Double Primary, Double Secondary, Multiratio, Metering Accuracy: 0.3B2.0

low cost

low weight

...and brown boveri dependability



Single-Phase Potential Transformer 161 kV
BIL 750 kV, Ratio 1400/800:1 with tertiary winding, Accuracy: 0.3 WXYZ

CHECK ALL THESE ADVANTAGES:

1. Priced for economy-minded, quality-conscious purchasers. Low cost is made possible by mass production of insulator type transformers used with the advanced-design Brown Boveri Air Blast Breakers.
2. Newly designed for extreme light weight and small size.
3. No erection costs at the job site. They are shipped from the factory completely assembled, filled with oil, tested, ready for installation.
4. Designed for minimum maintenance.
5. No extra charges for non-preferred ASA primary current ratings of current transformers.
6. No extra charges for tertiary winding of potential transformers.
7. Backed by the world-famous engineering and production background of Brown Boveri.

SUITABLE for both revenue METERING and RELAYING, these Brown Boveri instrument transformers are available for outdoor service in all standard ASA voltage classes: 34.5 kV to 345 kV and higher.

The remarkably low prices of these current and potential transformers — particularly those at higher voltages, invite comparison by astute users. They discover that they can make substantial dollar savings while securing thoroughly dependable, proven-in-the-field reliability when they specify Brown Boveri. *Write for data.*

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BROWN BOVERI CORPORATION

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SALES OFFICES

Atlanta, Ga. • Birmingham, Ala. • Boston, Mass. • Butte, Mont. • Chicago, Ill. • Cleveland, O. • Denver, Colo. • Detroit, Mich. • High Point, N.C. • Jacksonville, Fla. • Kansas City, Mo. • Knoxville, Tenn. • Lewiston, Me. • Los Angeles, Cal. • Minneapolis, Minn. • New Orleans, La. • New York, N.Y. • Portland, Ore. • San Francisco, Cal. • Seattle, Wash. • Tucson, Ariz.

MAIN OFFICE is lighted by a luminous ceiling that provides about 95 ft-c in the working areas and 64 ft-c over the counter

IN THE LOBBY the intensity ranges from 100 ft-c to 65 ft-c, produced by recessed 200-w lamps and perimeter fluorescent lamps

Remodeling Produces 300% More Light For Utility

C. M. THOMPSON, Engineer-in-Charge, Lighting Sales, San Diego Gas & Electric Co, California

More light by 300% is the result of the remodeling done by San Diego Gas & Electric Co in its main floor office and lobby. Quality lighting and modern architectural design were combined to make the office an example of adequate illumination for the utility's customers.

The installation replaces a group of 1,500-w, indirect lighting fixtures in the office that provided only 12-15 ft-c of illumination. The new system consists of rows of fluorescent lamps on 2-ft centers and 3 ft above a corrugated plastic diffuser. The combination produces the effect of a luminous ceiling. The lamps are 2 ft below the top of the 5-ft ceiling cavity that is painted gloss white. Even the air conditioning ducts were painted white to maximize the amount of light reflected to the diffuser.

The luminous ceiling produces an intensity over the work area of about 95 ft-c and over the counter area about 64 ft-c. Cove lighting and 4x8-ft recessed ceiling fixtures in the public area provide 50 ft-c. Light desk tops having a brightness about one-third that of the ceiling are used in the office.

In the entrance lobby are recessed fixtures with 300-w, silvered-bowl lamps and cove lighting. At the elevators, 200-w recessed lens units and perimeter wall lighting, consisting of T-12 fluorescent lamps, give 65-100 ft-c.

Exhibit Displays Proper Home Lighting To Utility Customers

Three phases of proper home lighting were demonstrated to customers through a lighting exhibit developed by Public Service Co of Colorado for the Denver Home Show. A secondary objective was further to acquaint the attendance of about 35,000 with the celebration of Light's Diamond Jubilee.

These phases were covered by the exhibit: The basic livingroom lighting units; lighting for general room illumination; and decorative home lighting for display purposes. Sidewall panels of the exhibit were of corrugated glass fiber material. Over the back of these panels was stretched a coarse green cloth through which light was filtered from two 8-ft slimline fluorescent lamps. The light was reflected from a plain white surface back

THREE PHASES of lighting are covered by this exhibit at Denver's Home Show: basic livingroom lighting; general room illumination; and decorative home lighting for display purposes

of the side panels to give a very soft even lighting. This added to the general illumination of the exhibit.

A planter in the dining area was lighted by two 150-w recessed downspot fixtures to give about 450 ft-c on the planter. A lighted valance and a combination fixture incorporating downspot lighting, as well as general illumination, also were used in the area. A niche in the rear was lighted by colored fluorescent lamps producing colors of white, gold, green and pink. This combination produced a very unusual and attractive lighting effect.

In the livingroom, an 8-ft lighted valance was used to bring out the colors of the drapery and added to the general illumination. For seeing tasks, a certified study lamp and a CLM senior floor lamp and swing-arm bridge lamp were specified.

To advertise the Diamond Jubilee, 18-in. replicas of the jubilee medallion were displayed on both side-front panels. Attention was drawn to the exhibit by a rotating diamond of mirrors lighted by a fluorescent lamp and mounted over the dining area. Handouts available at the exhibit included the GE booklet "See Your Home in a New Light" and a PSCo bill stuffer pamphlet explaining the significance of the jubilee.

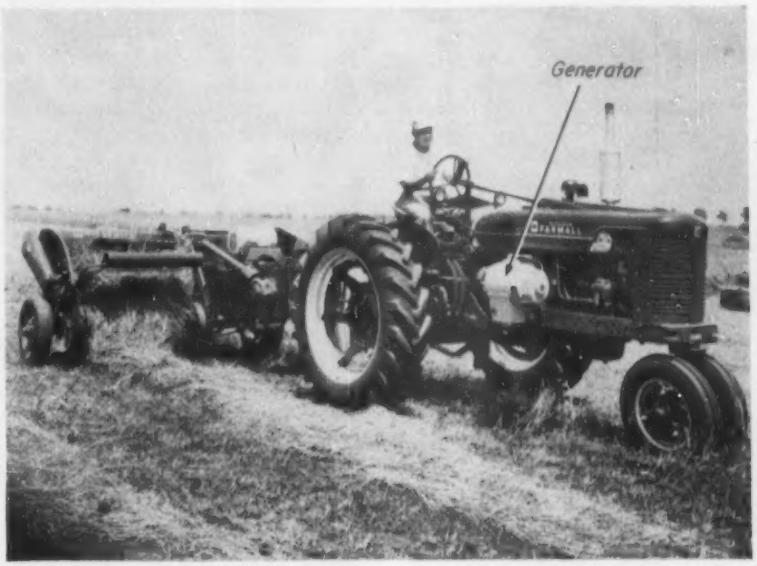
PSCo feels displays of this type pay off in two ways. Commented John N. Kerr, Jr., director of PSCo's information department. "This display is paying off through home lighting survey appointments which customers sign for at the booth and through customers' requests for the 'See Your Home in a New Light' booklet, indicating their interest in solving their own home lighting problems."

Irrigation Pays Carolina Farmer

Supplemental irrigation has paid off during crucial dry periods, according to a new booklet just published by the agricultural development department of Carolina Power & Light Company.

The booklet, entitled "Droughts or Dollars?", tabulates the experiences of more than 500 Carolina farmers who use supplemental irrigation. Agricultural development agents for CP&L, sent questionnaires to the individual farmers and carefully analyzed and tabulated the farmers' own appraisal of their systems.

Invariably, said the farmers, supplemental irrigation increased yields. Average increases ranged from 20% for cotton to as high as 420% for cucumbers, 137% for okra and 125% for pastures. Tobacco yields were boosted an average of 35% with some growers reporting as much as 200% increase in leaf production. The booklet reports on 25 crops, the number of acres irrigated, the cost, the frequency of irrigation and the resultant increases in yield.



TEN-KILOWATT GENERATOR, mounted on side of tractor, is driven by tractor engine and in turn drives motor which runs hay baler. Normally, separate engine drives hay baler

Mobile Power Demonstrated

Mobile electrical power for farm and other operations was demonstrated jointly by the International Harvester Co and the General Electric Co on June 22 at the International Harvester Company's farm near Hinsdale, Ill. The power was provided by a 10-kw generator. The demonstration included generators mounted on tractors and driven by the tractor engine through gears and a pulley to a V-belt drive. One generator was mounted on a truck and driven in a similar manner by the truck engine.

Advantages of this new source of power is the ability to have it wherever the tractor or the truck can be driven, and the flexibility of electrical drives as compared with other types.

Uses demonstrated included: operation of the hay baler; operation of a thrashing machine; water pumping; and the operation of many types of electrical tools such as the power saw for cutting wood, drill press, drill, circular hand saw, welding, air compressor, a small concrete mixer and others.

Sponsors of the new generator emphasized the fact that they do not expect it to compete with electric utility or co-op power. The new generator can be plugged in on the general house service lines and used in an emergency in case of power interruption. It's use in such emergencies is expected to be one of the important advantages.

Generation is three phase 120/208 volts, with the neutral point of the wye connection grounded for safety reasons. There are three connection plugs which provide 120-v single-phase service, 208-v single-phase or 208-v volt three-phase.

Potential applications for the new generator include the supply of power for power driven tools of building contractors and others that work where the normal power supply is not yet available. Such applications could very well include the driving of power tools for line crews, with the generator driven by the truck engine.

LETTERS TO THE EDITOR

Mobile Atomic Power Plant—A Practical Lab

To the Editor:

I have been reading with considerable interest the articles you have been running on the atomic power plant to be operated by the Duquesne Light Co. I also have just reread the statement made by Dr John R. Dunning, Columbia University's Dean of Engineering, at the EEI meeting in June. Dr. Dunning's theme was that it is up to the power companies to seize the initiative in the development of other types of reactor systems for developing power.

The idea is probably not original with me, but I believe that one such application of atomic power generation that might be feasible for electric utility use in the very near future might be a power train. It would serve as a source of incremental power while providing a practical laboratory for further research and operating experience.

Admittedly, in the near future, atomic power generation will not be competitive economically with present fuel-fired plants except in the regions of high fuel costs. However, incremental and emergency power is usually not cheap either, comparatively.

Although the cost of developing and building such a train may be as high if not higher than the Pittsburgh installation on a kilowatt basis, the mobility feature might make it attractive to a combination of private utilities, located close to each other. With no actual data available, this suggestion may border on sheer fantasy, but this writer offers the following outline for such a unit:

1. Capacity to be around 10,000 kw. The power trains owned and operated by the U.S. Navy might show the way of putting such a unit on railroad cars, speaking only of the steam turbine and generator set, including auxiliaries.

2. Atomic reactor and heat exchanger units (if the latter are needed) to be mounted on a second set of railroad cars.

3. Under actual operating conditions, the reactor and the generator trains would be separated and placed on parallel sidings. Prebuilt facilities by the utility to whose system the unit is to be connected would include adequate shielding (concrete, etc.) around an enclosure into which the reactor car would be moved. Other prebuilt facilities would include high pressure piping already in place for the steam connections from reactor train to turbine set, control circuits, and perhaps even transformer and substation facilities to interconnect the power train. Present outdoor and semi-outdoor generating plants should provide experience data for outdoor piping and control systems.

4. Connections would be made from the trains to the permanent installation. Actual controls would be operated from a control car attached to one or the other of the two portions of the power train.

5. Certain operating and design data from the submarine "Nautilus," if available, should provide design information for a reactor that will withstand mechanical shock of movement and utilize small space limitations.

6. The combine of utility companies could pay outright for the cost of the generating section and auxiliaries as well as each company paying directly for its own permanent facilities. The combine could also contribute toward the reactor section and pay operating costs and wages of any specialists the AEC feels are necessary to operate that end of the unit.

7. Primary use of such an atomic power plant would be for such cases as standby during low water periods, load and voltage maintenance during scheduled and emergency outages, incremental power during seasonal load peaks, etc.

This writer has no source for estimated costs of such a power train; but with total construction cost figured at approximately $300-350 per kw, the cost to each of say five companies would be about $600,000 or $700,000 plus the cost of their own facilities. This isn't a small amount of money, but it may be a not too expensive way of getting emergncy power and contributing something to the still small pool of atomic power generation knowledge. Perhaps some of your other readers may have some suggestions on this project.

E. Silverman

Training Aids Supply Co
1058 Wright Street
Valley Stream, L. I.

40 Million Homes Inadequately Wired

To the Editor:

I have looked with interest on some advertising that you have been sponsoring in connection with the Adequate Wiring Bureau's work (EW, May 31, p 52). I have one before me entitled, "Why Cats Have Nine Lives," (EW, May 31, p 18) and notice in the text of this sheet that you mention in the second paragraph that there are 20 million houses in this country with inadequate wiring. I would like very much to know where you obtained this information and just how accurate you believe it to be. The figures at which I have been able to arrive, and I am very anxious that they be correct, is that there are some 47 million of them inadequately wired.

I am very frank to say that I know of but one house in the city of Birmingham which I would call adequately wired. And the age of the houses has very little to do with it. However, some of the more expensive residences, built in the last few years by their owners, have nearer adequacy than do the vast majority of the homes built by promotional builders under FHA regulations.

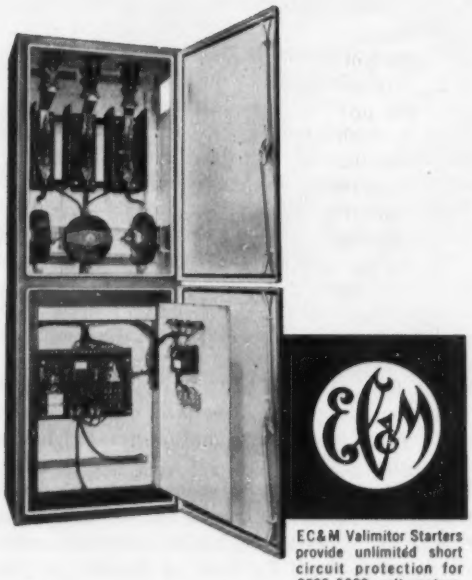
I think your figure of 20 million houses inadequately wired is considerably less than 50% accurate.

D. B. Clayton, Sr
President

National Electrical Contractors Association
1200 18th Street, NW
Washington 6, D. C.

• EW heartily agrees with Mr Clayton. The figure has already been changed to 40 million in the other ads in this industry-approved series.

...FOR WANT OF SHORT CIRCUIT PROTECTION



EC&M Valimitor Starters provide unlimited short circuit protection for 2200-5000 volt motors.

EC&M Motor Starters could have prevented this work stoppage . . . the costly downtime, the delay, the repairs. Unlimited protection against fault currents, regardless of their magnitude, is assured by the Valimitor Starters (volt-ampere-limitor) for 2200-5000 volt motors.

When you install these Valimitor Starters, there is no need to calculate existing KVA . . . no problem of estimating future requirements. These unique Motor Starters will limit the maximum fault current to 25,000 KVA, even if the bus has infinite capacity.

In addition to the Valimitor type, EC&M Motor Starters are available in 50,000 KVA interrupting capacity. Both can be supplied with weather-resistant, explosionproof, or other enclosures to meet any operating conditions.

Whatever your requirements, EC&M Motor Starters will provide the protection you need against losses caused by fault currents.

Any way you figure it . . . short circuit protection is your best buy!

Write today for Booklet 1062 for complete details.

THE ELECTRIC CONTROLLER & MFG. CO.

2698 EAST 79th STREET • CLEVELAND 4, OHIO

NEWS ABOUT PEOPLE

WALTER A. STEINER ARTHUR C. BRYAN WILLIAM H. FEATHERS

National Carbon Names 3 VPs

Bryan will be general manager of Consumer Products; Feathers, Industrial Products and Steiner, Development

The National Carbon Co, a division of the Union Carbide & Carbon Corp, has announced the election of Arthur C. Bryan, William H. Feathers, and Walter A. Steiner as vice presidents. Bryan will be general manager of Consumer Products; Feathers, general manager of Industrial Products, and Steiner will be in charge of Development.

Bryan has been with the company in various sales activities since 1935. He joined the company as an industrial salesman in the Chicago office and five years later was appointed a district manager in the New York office. From that position he moved to Cleveland, Ohio, as assistant manager of the Carbon Sales Division there.

Becomes General Sales Manager . . . Later, Bryan held the post of division manager of the Kansas City sales office. He next became assistant general sales manager for the company. In 1949 he was promoted to general sales manager.

Feathers came with the company in 1937 at Niagara Falls. Five years later he was made head of the Works Laboratory at the Niagara plant. He became assistant superintendent of the Columbia, Tenn., plant in 1943. In 1949, he was made general superintendent of the three Niagara plants of National Carbon. He was transferred to Cleveland as assistant to the vice president in charge of production in 1952.

Steiner Came From Germany . . . Steiner was graduated from Polytechnicum Mittweida in Mittweida, Germany, in 1924 with an M.E. in Mechanical Engineering and was hired by the company that same year. He served in various capacities at different locations and in 1929 was made assistant chief engineer. Steiner was made assistant superintendent of the Fostoria plant in 1936 and in 1937 was assistant to the director of the Research Laboratories. From 1938 until 1944 he handled special assignments and in 1944 became product manager for Industrial Products. In 1953 he was made general product manager over the company products.

Darrin of GE Retires

Ralph M. Darrin, commercial vice president in charge of customer relations in the New York and New England areas, has retired after 35 years of service.

Following executive assignments at General Electric district offices at Buffalo and Syracuse, Darrin was transferred to New York in 1945 as district manager of transportation for the company's Apparatus Division. He was named a commercial vice president of the New England district in 1949 with headquarters in Boston. In 1951 Darrin was transferred to the GE executive offices in New York in charge of both the New York and New England areas.

PG&E Names Herbeck Hydro Superintendent

William H. Herbeck, district superintendent of Pacific Gas & Electric Co's Feather River plants has been named general superintendent of hydroelectric generation of the company. He succeeded Earle A. Crellin who retired July 1.

Herbeck worked on construction jobs in many states before joining PG&E in Shasta County in 1923 as a machinist in the maintenance of hydroelectric plants. From 1926 until 1946 he was stationed in the company's Drum Division, headquartered at Auburn, where he rose to general foreman of hydroelectric maintenance in 1945. In 1946 he was transferred to the company's San Francisco general office as maintenance supervisor and in 1948 was made district superintendent on the Feather River.

Crellin began his career with PG&E in 1920 as a designer of hydroelectric plants and has been general superintendent of hydroelectric generation since 1950.

•

Mark E. Maxon has retired as vice president, treasurer, and sales manager of The Brewer-Titchener Corp. He had been with the company for 35 years. He has been a director of the corporation for 20 years. He joined the corporation in 1919 as a member of the sales department.

Dwight H. Ladd has been appointed manager of the Dallas, Tex., plant of Federal Electric Products Co and its subsidairy Pacific Electric Manufacturing Corp. He is a graduate engineer and has been active in the engineering field for the past 24 years.

E. C. Fleischli has been named to the newly created position of sales manager of Central Illinois Light Co. He entered the company's service on May 16, 1924 as an outside appliance salesman and in 1926 was appointed appliance department manager, a position he held until his new assignment.

Henry B. Sargent, president and general manager of the Arizona Public Service Co, has become a new member of the board of directors of Stanford Research Institute.

● Noon or midnight the loading area of this Ryerson plant looks much the same because we work 'round the clock to make sure that you get Ryerson Steel when you need it. Carbon steel, alloy steel, stainless—every kind is on hand, in practically every shape and size. Your requirements can be set down where you want them, quickly, cut to size and ready for immediate use. Just call the nearest Ryerson plant.

PLANTS AT: NEW YORK • BOSTON • PHILADELPHIA • CHARLOTTE, N. C.
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RYERSON

EUGENE C. STARR

Starr Becomes BPA's New Chief Engineer

Eugene C. Starr is the new chief engineer of Bonneville Power Administration. A former professor of electrical engineering at Oregon State College, Corvallis, he assumed the post July 1. He replaced Sol E. Schultz, who resigned in June.

Having served as consulting engineer for BPA since 1939, Starr is familiar with Bonneville's transmission system and its problems. He is recognized nationally and world-wide as an authority in the field of high voltage transmission, according to Bonneville Administrator William A. Pearl.

A native of Oregon, Starr received his electrical engineering degree in 1938 from Oregon State College. He has taught there continuously since 1927. Before teaching, he took the General Electric graduate engineer course and served for a year as a high voltage engineer. In 1930 and 1941, he won the AIEE best-paper prizes in theory and research. He was appointed civilian scientific observer for the Bikini atomic bomb tests in 1946. Starr now is a consultant to the reactor development division of the Atomic Energy Commission.

Currently a fellow in the AIEE and a member of several national committees, he is also a member of the American Association for the Advancement of Science, Institute of Radio Engineers.

MURRAY IRELAND

Ireland Made President of Toastmaster Products

Murray Ireland has been named president of the Toastmaster Products Division of the McGraw Electric Co succeeding D. S. Campbell who will continue as vice president of the company. Ireland will also be responsible for quality control in all of the company's appliance manufacturing plants. Campbell will devote his time to investigations in connection with the expansion of the company.

Ireland's association with the automatic toaster industry dates back to its birth. He joined the Toastmaster division in 1925 as designing engineer. In 1927 he became superintendent and in 1943 was elected a vice president of the company in charge of production for the Division of Elgin, Ill.

Penniman Is Elected ASME Honorary Member

Abbott Lawrence Penniman, Jr, vice president, Consolidated Gas Electric Light & Power Co of Baltimore, has been elected to the honorary membership of the American Society of Mechanical Engineers. The rank, awarded for "acknowledged eminence in the engineering field," is the highest honor conferred by ASME. Only 150-odd honorary members have been elected since the Society's founding in 1880.

AG&E Makes Changes in Legal Department

American Gas & Electric Service Corp has appointed Herbert B. Cohn as chief counsel and Thomas H. Sayre as assistant counsel.

Cohn, who has been an attorney in the legal department of the Service Corp since October, 1948, succeeds C. E. Moore, who retired on June 30.

A native New Yorker, Cohn was graduated from Yale University with a bachelor of arts degree in 1933 and Harvard Law School in 1936. He worked from 1936-43 on legal work for the Securities and Exchange Commission, and after more than 3½ years in the U. S. Navy returned to the SEC to become executive assistant and director of the division of opinion writing from 1946-48.

Sayre a native of Ohio, has been an attorney in the legal department of AGE since he was graduated from New York University's law school in 1942.

•

Sidney B. Westby has been appointed manager of the Territorial Information Department of Commonwealth Edison Co. He succeeds George R. Mitten, who recently was named manager of the industrial department of the Chicago Association of Commerce and Industry. Westby has served in Edison's Industrial Development Department for nine years, the last two as assistant manager.

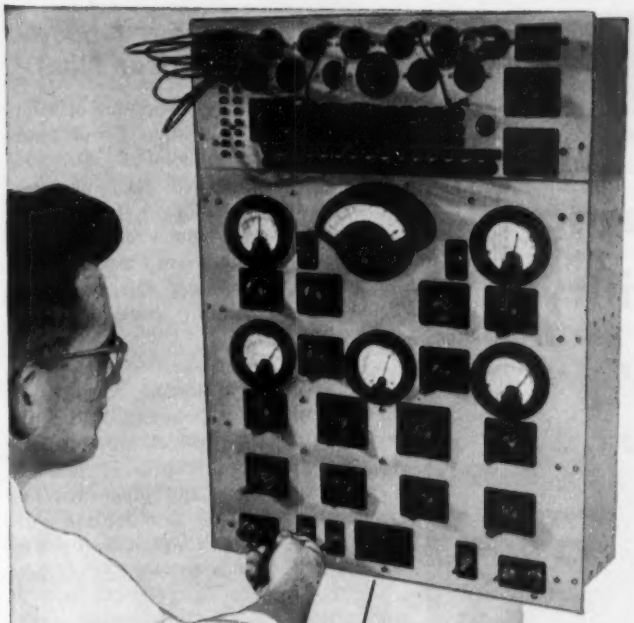
Ralph H. Smith, controller, Cleveland Electric Illuminating Co, has been named a trustee of Controllership Foundation, Inc, effective Sept. 1. The Foundation is the research arm of Comptrollers Institute of America.

OBITUARY

Dallas J. Fike, 84, former general manager of Meyersdale Electric Light Co died recently at his home in Meyersdale, Ohio.

Dr. Saul Dushman, 71, formerly an assistant director of the General Electric Co research laboratory, died recently in Scotia, New York. He had been a GE scientist for some 37 years.

Charles Noble Mason, 84, former president and chairman of the board of the Electrical Securities Corp of New York, a subsidiary of General Electric Co, died recently in New York City.



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The *Gm x 1* range is especially useful in the measurement of subminiature tubes having low transconductance.

Reliability, Dependability and **Accuracy** assured by sound engineering, skilled manufacture and high quality components.

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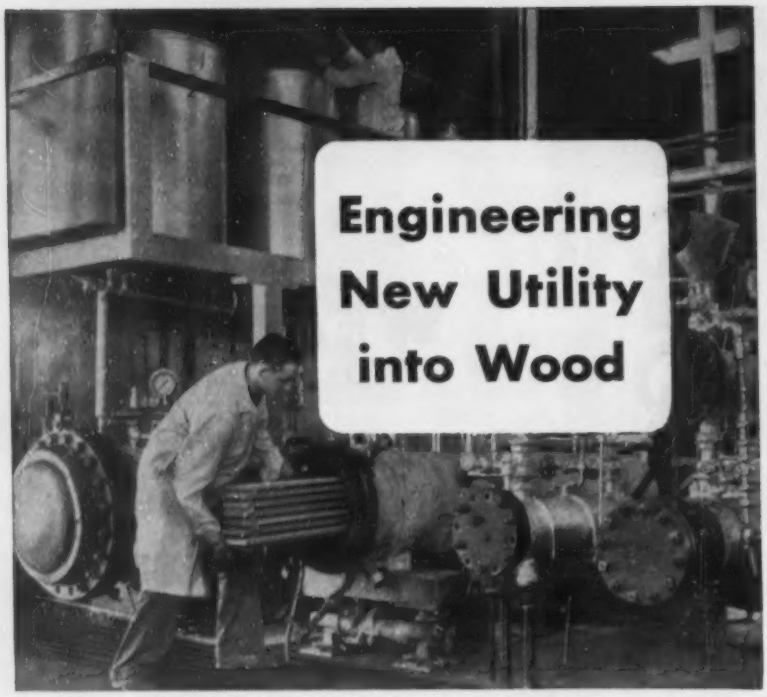

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Colorado Co-ops Propose REA-AEC Nuclear Plant

Colorado State Association of Rural Electric Administration Cooperatives has proposed a joint REA-Atomic Energy Commission pilot plant in southwestern Colorado to produce power from a uranium reactor.

The association sent letters to Colorado's Congressional delegation asking assistance in developing the project.

The REA association said four southwestern Colorado cooperatives had formed the Colorado UTE Electric Association to seek more electric power supplies. The letter said "it seems certain at this point that the REA will grant a loan for the construction of a steam plant and power distribution lines to the Colorado UTE group.

"If this is done," the letter added, "there would exist all of the basic elements for a pilot plant partnership, namely the rural electric co-ops' financing, building and operating the basic plant and the AEC paying the difference between this and the cost of the reactor."

The association claimed these five points as favorable factors for a uranium-electric plant in southwest Colorado:

1. The area is a major source of uranium.

2. It is isolated and not fully served by a commercial utility.

3. Power costs at present are high.

4. Terrain offers security.

5. The demand for power "fits logically" into the AEC's pilot program on atomic reactors.

Northwest Group Asks A-Power 'Partnership'

Extension of the Administration's proposed partnership program for hydroelectric projects to atomic energy has been proposed by the Puget Sound Utilities Council, composed of one private and four public power utilities in western Washington.

Meeting at Seattle, the Council voted to ask Atomic Energy Commission whether any joint action in atomic power development would be feasible. Eugene Starr of Oregon State College, previously retained by the council but recently made chief

engineer of the Bonneville Power Administration, was named to represent the council in talks with AEC.

The council includes Seattle and Tacoma City Light, Puget Sound Power & Light Co, and the Chelan and Snohomish County PUD's.

Funds Cut Will Not Slow Work on Corps Projects

Work at The Dalles Dam on the Columbia River is expected to continue at full speed, despite the failure of Congress to appropriate the full $45 million requested for the project by the Army Corps of Engineers.

Col Lewis H. Foote, North Pacific Division engineer at Portland, Ore., received an order issued by Maj Gen Samuel D. Sturgis, Jr, chief of the corps, to proceed with original construction plans during the coming year.

Although Congress appropriated only $36 million for the $348,372,000 project in its annual civil functions money bill, it adopted special language in the accompanying report which provides that funds be spent in such manner as to meet previously approved power deadlines for the first four units at The Dalles—and also to meet schedules at Chief Joseph Dam, Wash., Buford Dam, Ga., and Garrison Dam, N. D. This language in the order has been interpreted as taking precedence over the specific dollar allocation.

To keep on schedule at The Dalles, the corps may ask for a supplemental appropriation next January, or may be able to transfer extra funds now earmarked for other projects.

The Dalles' schedule provides that the first two of 14 generators will be in operation by November, 1957.

New Surge Generator

University of Virginia's School of Engineering has completed construction of a 1.5 million v surge generator for power line and transformer testing. The generator can produce current levels of 4,000 amp of 1.5 million v. It will be used for research but also will be available to Virginia utilities and electric equipment manufacturing companies for testing purposes.

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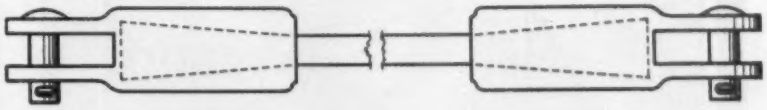

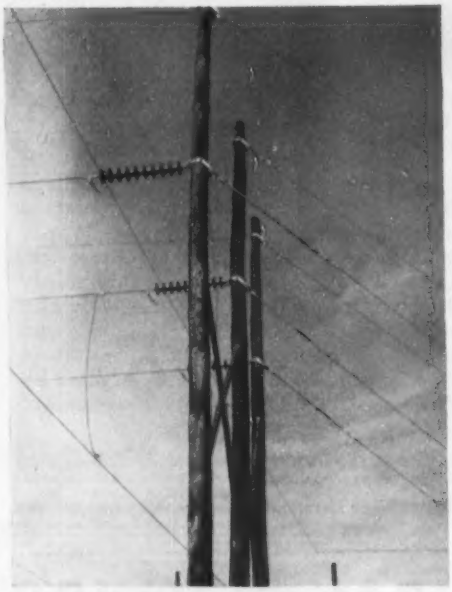

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SMUD's Electric Rates

(*Continued from page* 102)

tion in 1947. The first reduction, on June 30, 1949, amounted to $372,000 a year; the second, on August 28, 1951, totaled $482,600.

These reductions, considered with recent rate increases by other electric utilities, will mean SMUD rates will average 27.3% lower than rates in comparable areas of northern and central California. Based upon present electric sales, this saving will exceed $4.2 million a year, Miller said.

James E. McCaffrey, SMUD general manager and chief engineer, said a residential customer with an electric range and water heater and using 500 kwhr monthly would pay $6.73 under the new rate. Comparable bill for 500 kwhr in Stockton, San Jose, Fresno, and Richmond is $9.78 a month, or 45% higher, according to McCaffrey. "The increased use of electric power which is sure to follow SMUD's lower rates," McCaffrey added, "will require a speed-up in the construction of power generating facilities in addition to receiving CVP power. The first phase of this program is under study and will probably consist of building a steam-electric plant sometime in 1956. Development of hydro power on the upper American River also is being studied."

Private Sales . . .

. . . need teamwork of lawyers and attorneys, says E. R. Morris of New York Life Insurance

Direct-placement financing by corporations can be speeded up if you have teamwork between attorneys and accountants. This was stated by Edwin R. Morris of New York Life Insurance Co in an article titled "The Role of the Accountant in Direct-Placement Financing" in the July issue of The Journal of Accountancy, published by the American Institute of Accountants. Morris has been assisting the administration and service of direct placements of the insurance company for the last six years.

It is surprising, he said, "how often a simple question by an accountant has directed the attention of all the interested parties to some particularly difficult language which fails to say

what is meant." He pointed out that this assistance is valuable to the lender because it will cost him "both time and money" later if one or more of the covenants becomes impossible to fulfill, and must be modified.

Loan Agreement Has Two Parts . . . The relationship between the borrower and the lender, he stated, is usually specified in a loan agreement. It is in two parts: The purchase agreement (or agreement to lend) and the security instrument.

Although a "fair amount" of private financing is done by mortgage bonds and debentures, the majority is handled through simple promissory notes, Morris declared. An option is included that the lender can exchange large denomination notes for $1,000 units so that they can be more marketable.

The New York Life Insurance direct placement specialist said that a typical note begins with the promise to pay principal and interest. In almost every instance the borrower retains the right to redeem all or any part of the notes at a declining scale of call prices. Other provisions are included such as the right to redeem notes by using the proceeds from the sale of stock or by the application of a portion of retained net earnings.

The affirmative covenants appear next. They include such fundamentals as: Maintain an office where notices may be sent; pay principal and interest on indebtedness promptly when due; maintain and preserve corporate existence, leases, and franchises, etc.

Covenants Discussed . . . The restrictive or negative covenants comprise the next section. These are usually the subject of extensive negotiation. This permits the lender to take "immediate remedial action" if adversity should develop.

Default and remedies are discussed next. Some events of default are: Failure to pay any part of the principal when due; failure for 30 days to pay interest, etc.

The final section of the article deals with specific, and often unique, definitions of the key words and terms used in the note agreement.

If you are interested in a reprint of this article, it can be obtained by writing John Lawlor, managing editor, Journal of Accountancy, 270 Madison Ave., New York 16, N. Y.

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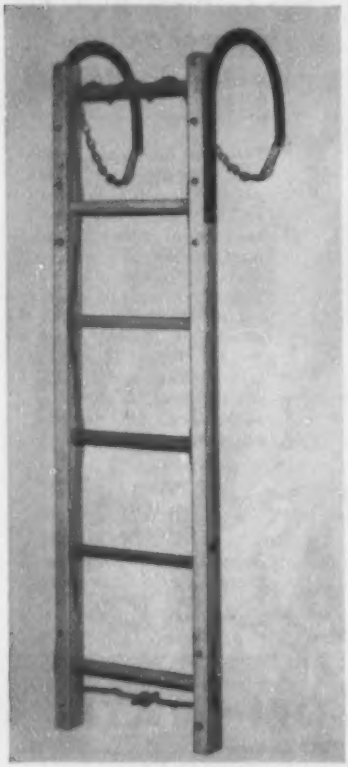

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POWER BRIEFS

● New generating units on the line: Niagara Mohawk Power Corp's South Colton hydroelectric plant went in service July 9. The plant is first of five being built by the company on the Raquette River. The five plants will have a capacity of 100,000 kw. West Penn Power Co's largest generating unit—135,000 kw—went on the line June 30 as an addition to the utility's Springdale Power Station. Second generating unit at Ontario Hydro-Electric Power Commission's new Sir Adam Beck Generating Station 2 went into operation late last month. The unit has a capacity of 75,000 kw.

● These additions were made during month of June: 66,000-kw unit at North Side Plant of City Public Service Board of San Antonio, Tex.; second 125,000-kw generator at Alabama Power Co's Barry Steam Plant; first 100,000-kw unit at Georgia Power Co's Hammond Plant near Rome; 150,000-kw turbine-generator at Detroit Edison's St. Clair Plant; 112,500-kw unit at Widows Creek steam plant of Tennessee Valley Authority and a 135,000-kw unit at the agency's Kingston steam plant; a 75,000-kw unit at Montville Plant of Connecticut Light & Power Co; and a 55,000-kw topping unit at South Street Station of Narragansett Electric Co, Providence, R. I.

● Pacific Bechtel Corp will build three steam plants in South Korea under the American economic aid program. Contract calls for construction of three power stations with a total capacity of 100,000 within 30 months. Plants will cost about $34 million.

● Carolina Power & Light Co plans to erect the largest generator in its system as an addition to its Cape Fear River plant near Moncure. Operating capacity of the $15-million addition will be 188,000 hp. Work will begin about the first of next year, and the generator is scheduled to go on the line in the second quarter of 1956.

● Savannah Electric & Power Co plans to expand its Riverside Power Station with the addition of a new 30,000-kw unit costing $6.5 million. It is scheduled for commercial operation in the fall of 1956. The utility this month will complete the addition of another 20,000-kw unit at the station.

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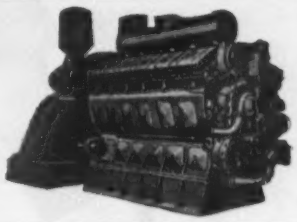

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1000	General Motors	16-567B	1440	720	300	General Motors	8-268A	450	1200
750	General Motors	12-567	1080	720	200	General Motors	8-268A	350	900
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500	General Motors	8-278A	750	720	150	Ingersoll-Rand	8-4	225	600
500	General Motors	8-567	720	720	150	Buckeye	80	240	600
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200	G. E.	2300	250
200	Westg.	4160	250
200	Ridgeway	2300	250
170	G. E.	440	125
150	G. E.	2300	125/250
150	G. E.	4000	250
150	A. C.	2300	275
150	G. E.	440	275
100	Westg.	440	125
100	Elec. Mach.	440	125
100	Ridgeway	2200	275
100	G. E.	240	230
100	G. E.	440	125
90	G. E.	440	60
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4	2500	Mol.	69000—13800
4	500	West.	69000—6900
3	400	G. E.	66000/33000—2300/4160
3	333	Stand.	69000/34500—7200/12470 Y
3	200	Pitts.	66000—2300
3	1500	Wag.	44000—6900
3	1250	A. C.	44000/11500—450
4	150	West.	44000/33000—2300/6900
3	75	West.	44000—7200/12470 Y
3	5000	G. E.	38100/66000—6600
3	3333	G. E.	38100/66000—33000
4	3125	Mol.	39900/69000 Y—26600/46000 Y
6	2000	Mol.	38100/66000—13800
4	4500	G. E.	36000—13300—2400
2	15000	West.	33000—2400/4160 Y, 3 ph.
1	5000	West.	34500—13750, 3 ph.
3	3333	G. E.	33000/11000—2400/7200
3	333	G. E.	33000—7200/12470 Y
3	200	A. C.	34500—2400/7200/12470 Y
3	75	Wag.	33000—7200/12470 Y
3	1250	G. E.	26400/13200—2400
4	1500	A. C.	25400/44000 Y—6900/13800
3	100	G. E.	22000—7200/12470 Y
3	50	G. E.	22000—2300
3	667	G. E.	13800—2300
1	600	Stand.	13200—2300, 3 ph.
1	450	Penna.	13200—2400, 3 ph. ASKAREL
3	333	G. E.	13200—2300
6	200	G. E.	13200—230/460
4	750	G. E.	11000—440
3	150	Wag.	6900—2300
3	37½	G. E.	6900—230/460
4	150	G. E.	4800/2400—240/120
2	100	G. E.	4800/2400—240/480
1	3000	G. E.	4160—480/277 PYRANOL
3	333	G. E.	2400/4160 Y—240/480
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3	200	West.	2400—240/480
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Qu.	KW	Make	Speed	DC Volts	DC Volts
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2	2000/2400	G.E.	450	250/300	2300/4600
2	2000	G.E.	514	600	6600/13200
1	2000	G.E.	500	600 25 cy.	11000
2	2000	G.E.	450	600	2300/4600
1	1500	C.W.	514	115	4000/13800
1	1500	G.E.	720	800	13200
1	1000	G.E.	900	260	4100/6900
2	1000	Whse.	900	600	2300/4150
3	1000	G.E.	720	600	2300/4600
1	750	Whse.	900	275	2300/4150
1	500	Whse.	1200	125/250	2300
1	500	Whse.	900	250	440
1	500	G.E.	720	125	2300

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Qu.	KW	Make	Desc.
1	4000	G.E.	Condensing—425 lbs—750° F.T.T.—Surface Condenser 3/60/2300-4000 v with exciter
1	1000	G.E.	Non-Cond—190 lbs-2400-3-60
1	1000	Moore	Condensing—Extraction—190 lbs., 2400-3-60—Surface Cond.
1	750	G.E.	Condensing—265 lbs., 440-3-60 Built 1944
1	500	Moore	Non-Cond—150/200 lbs., 5/25 lbs. B.P., 480-3-60 Dir. Conn. Exciter.
1	300	G.E.	Non-Cond—150/175 lbs., 5/10 lbs. B. P., 480-3-60

FREQUENCY CHANGERS

Qu.	Kva	Make	Cycles	Voltages
1	13900	Whse.	60/25	13200 x 13200
1	3750	G.E.	60/25	4150/2400 x 2400/4150
1	3125	G.E.	25/60	4150/2400 x 2400/4150
2	2500	G.E.	25/62½	2300 x 4150
1	1250	G.E.	25/58.3	4400 x 2300
1	625	A.C.	25/60	11000 x 2300

TRANSFORMERS—60 Cycle

KVA	Make	Type	Ph	Voltages
1	5000	Whse.	OISC	3	13000x26400/13200
1	2500	Whse.	OISC	3	26400/13200 x 480
3	2000	G.E.	HVDDJ	1	66000 x 13800
1	1500	G.E.	HT	3	13200 x 2300
3	1250	G.E.	HVDDJ		6600/550
3	1000	G.E.	HVDDJ	1	2200/480

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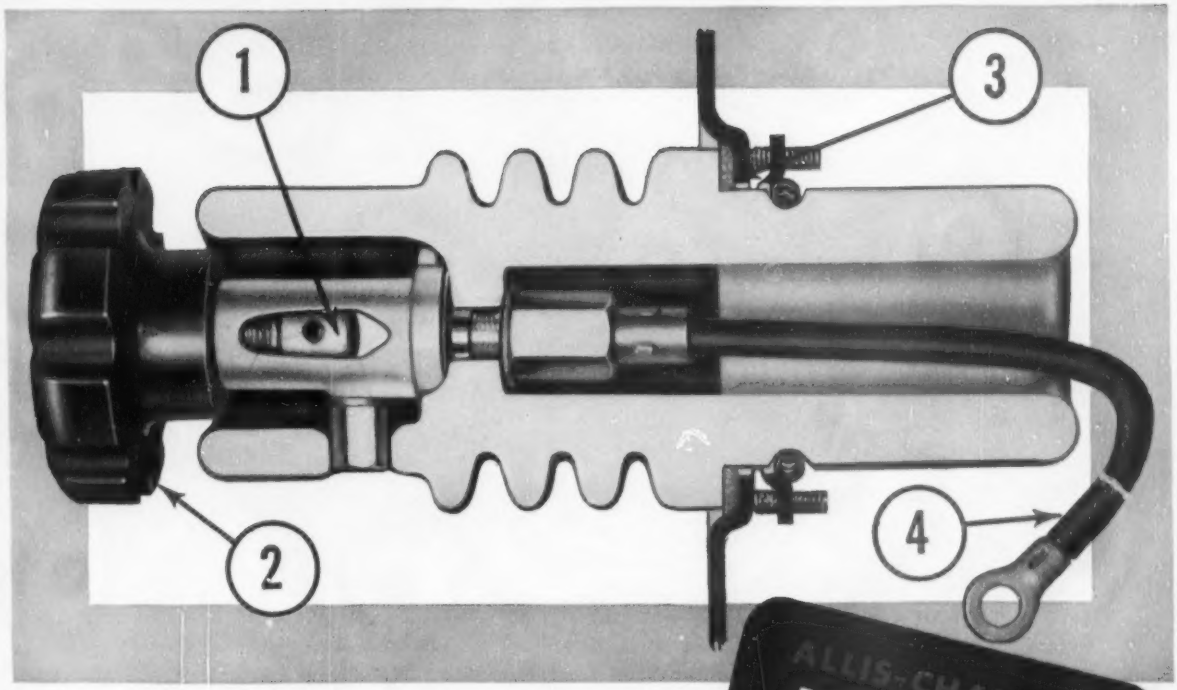

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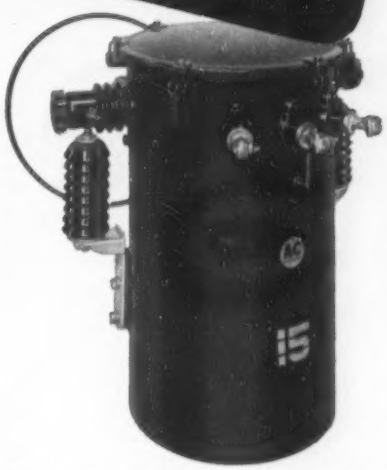

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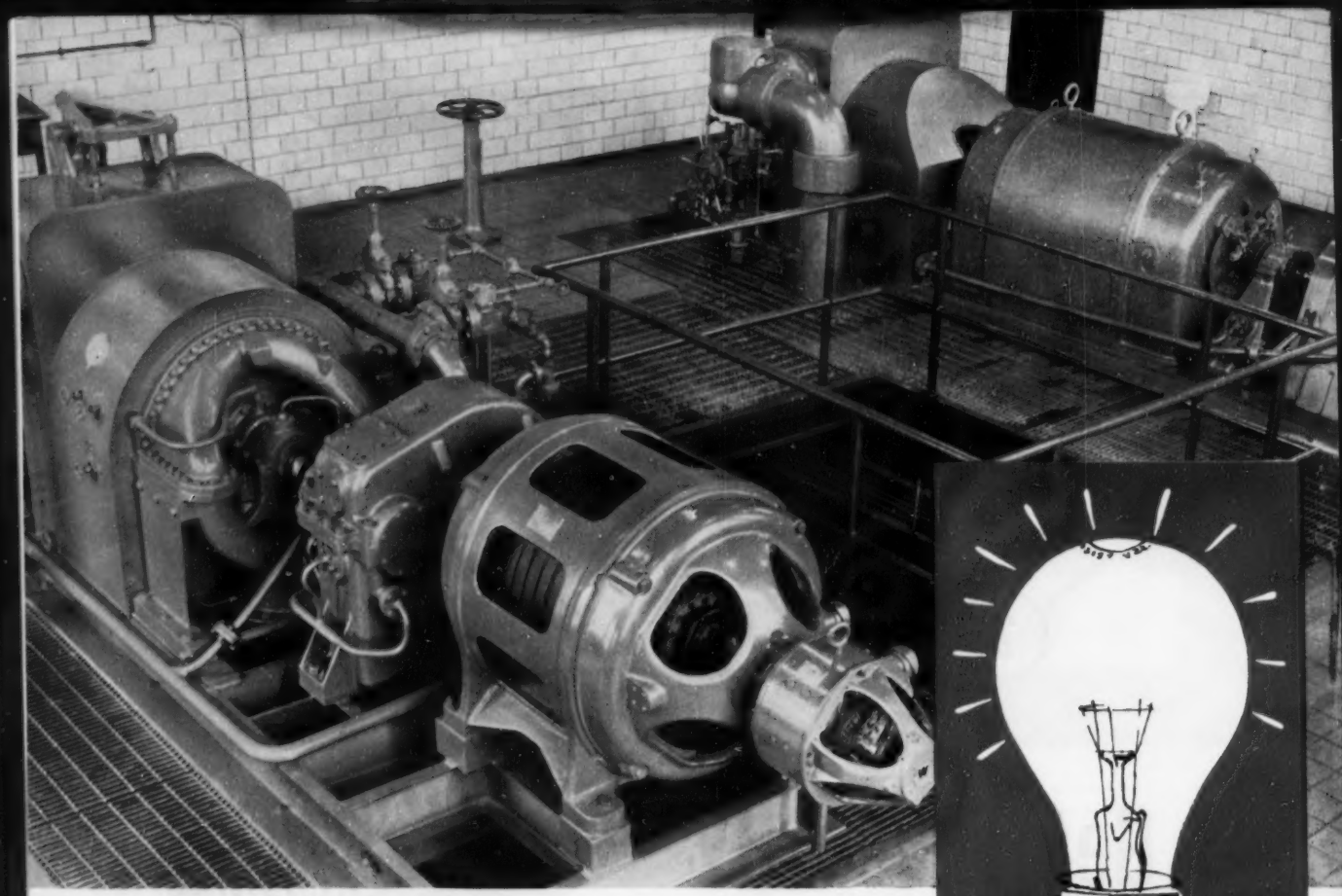

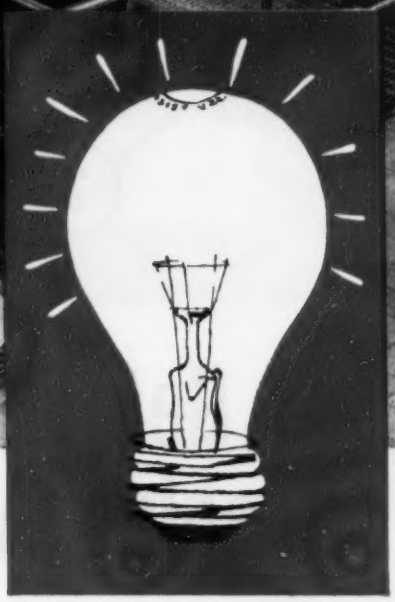

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NONPAREIL completely eliminated the troubles. For 13 years there has been no need for shutting down the turbine to clean the oil system. Centrifuging has been the only method of treating the oil. Acidity has always remained low—never over 0.09 mg. KOH/gm. When a new and larger (750 KW) unit was installed in 1947, outstanding past performance had sold NONPAREIL into another job.

The Standard Oil lubrication specialist near you will be glad to show you lubrication records of NONPAREIL in installations similar to yours. In the Midwest, phone your local Standard Oil office. Or write: Standard Oil Company, 910 S. Michigan Avenue, Chicago 80, Illinois.

NONPAREIL
TRADE MARK
Turbine Oil

Trouble-free operation is assured *for the life of all turbines* lubricated with NONPAREIL. With each fill goes a written guarantee that it will last as long as the turbine, and that the neutralization number will never exceed 0.15 mg. KOH/gm. Where can you beat such a promise of product performance?

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